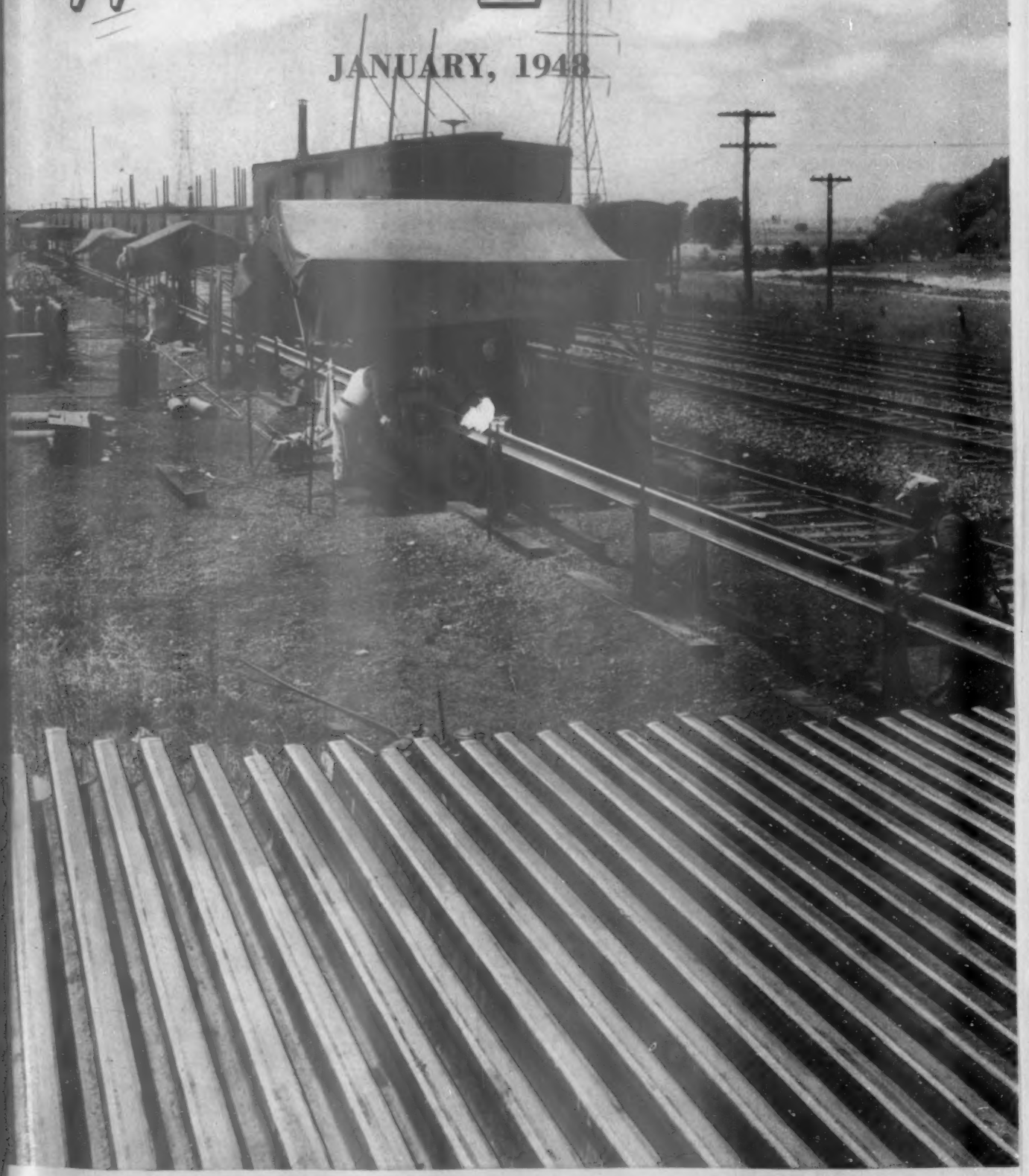
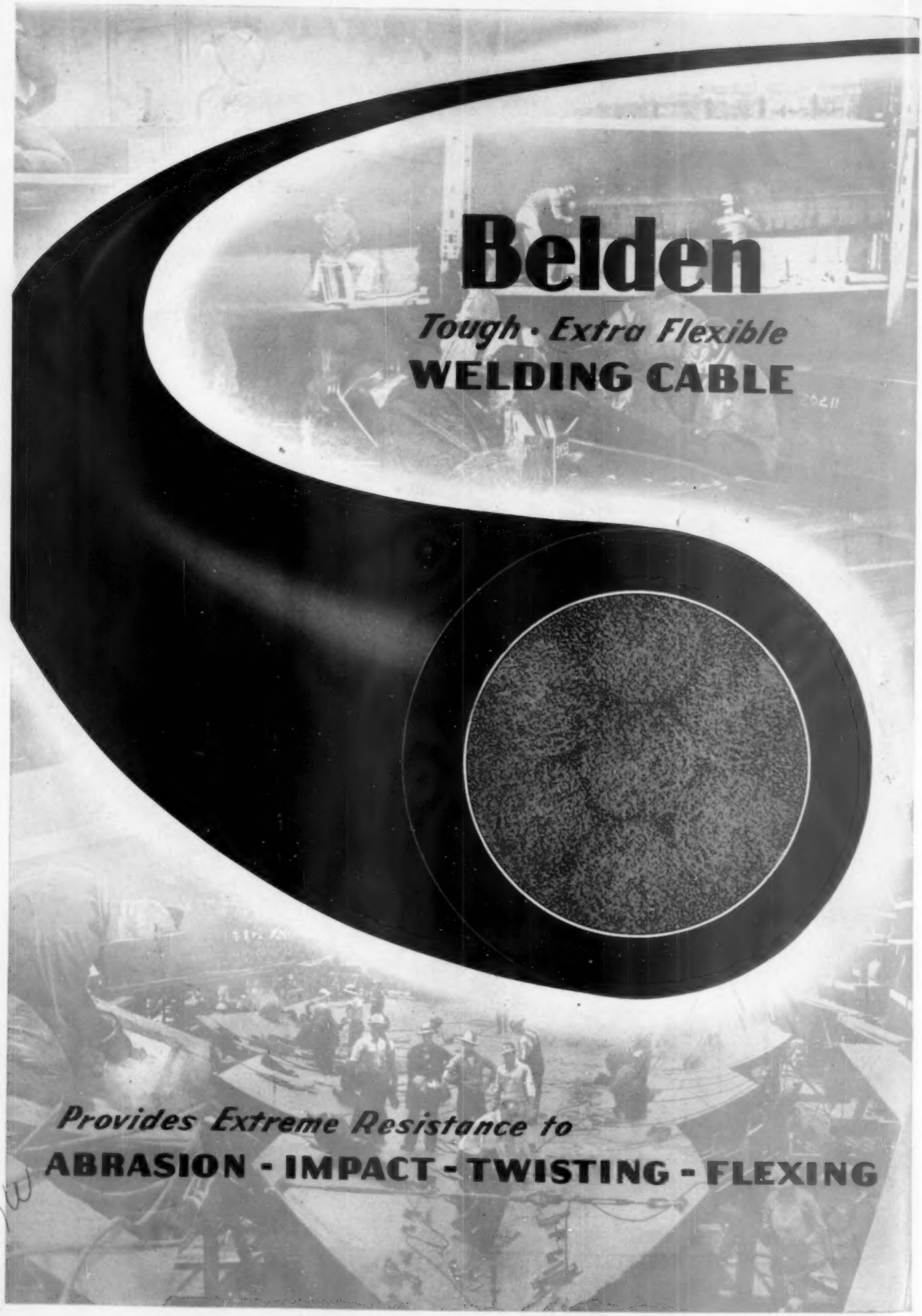
THE WELDING ENGINEER

JANUARY, 1948



THIS ISSUE: X-Ray Inspection of Spot Welds . . . page 54

A McGRAW-HILL PUBLICATION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THE WELDING ENGINEER

ESTABLISHED 1916 JANUARY, 1948

Ring in the New!

WITH THE BELLS of the New Year came the hope that "This will be the best year yet." It is everyone's fervent desire that this baby, 1948, which is yet so fresh and clean and sparkling, will be a year of triumphs and answered hopes. Unfortunately, however, the New Year must include some moments of despair and sorrow. Life just seems to be that way.

Regardless of the whims of Fate, the New Year must be faced with courage. It presents a challenge which must be met with stout hearts. It will bring some decisions that are going to be difficult to make. However, it will also bring new opportunities and new ventures.

WHAT WE MAKE IT

We in welding hail the New Year! We look forward to it with eager expectation. Unspoiled as yet, it can be what we will make it. If we are awake to its opportunities, 1948 can easily be made "our best year yet."

It might be thought that the reasons for using welding are well known to everyone in the metals industries. Not so. There are still too many fabricators who are not familiar with the advantages of this superior metal-joining process. Hence all readers of this page should make one big New Year's resolution: to resolve to point out the advantages of welded construction to every potential user. If we all did this, welding would make tremendous gains.

There are also too many manufacturers who aren't aware of what can be done with the judicious use of welding in product design. In most cases the welded redesign results in a superior product—a product that is more pleasing in appearance, more durable, lighter in weight, stronger and usually less costly.

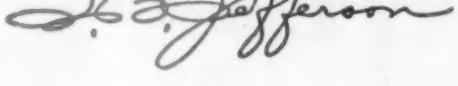
TALK WELDING CODES

Here is a specific educational job! Let's each make it his business to point out to engineers, designers, government agencies and/or regulatory bodies that there are available authentic codes and specifications dealing with welding. These are not codes based on guesswork—they have all been proved by service. Were it not for welding codes, we would not now have the atomic bomb. High-octane gasoline and countless other items that have contributed much to make life more worth living would also be missing.

Some petrified occupiers of high offices reject welding because of failures that occurred years ago. These fossils fail to recognize that the road of progress has always been built on an underlayer of failures. Because industry as a whole has learned to profit from its mistakes, we now have today's magnificent trains and planes and automobiles . . . to say nothing of better welding.

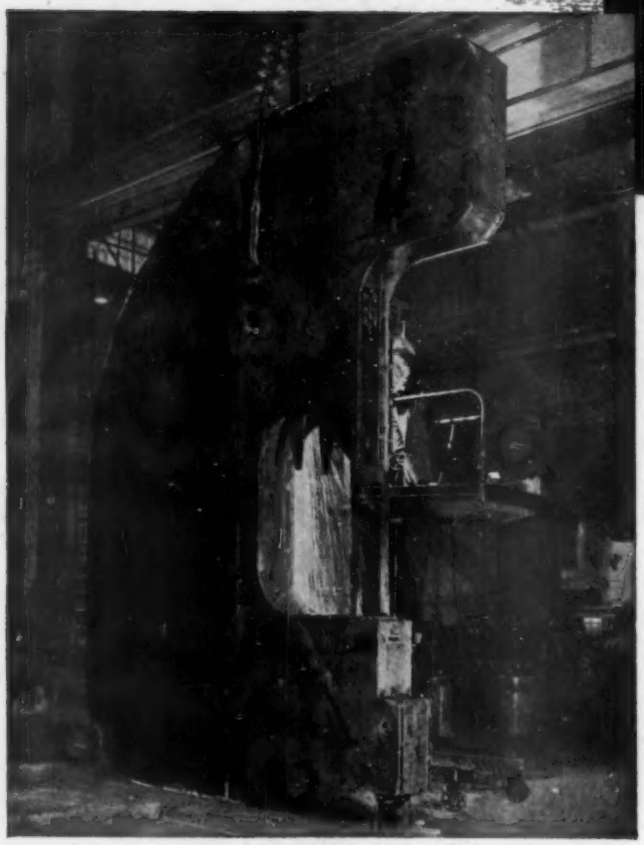
GET RID OF THE ROADBLOCKS

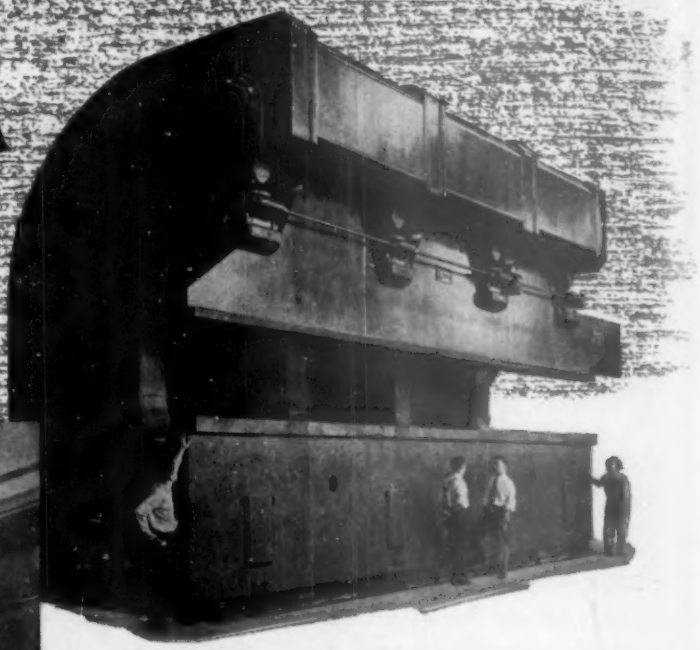
We in the welding industry have traveled far, and our way has been that of the bold explorer who uses past experiences only as stepping stones. Now we must all help to remove the roadblocks that impede the path of our progress.



WORLD'S LARGEST PRESS BRAKE

Welded with MUREX





In building the world's largest press brake, Warren City Manufacturing Company made sure of top quality welding by using Murex Electrodes.

This huge unit, of fully stress-relieved welded steel construction weighs more than a half million pounds without dies. It is designed to exert a pressure of over 1,000 tons for bending steel plate 5/8" thick to a right angle and in a single stroke in lengths up to 36 feet.

Manual welding involved the equivalent of 40,000 feet of 1/4" fillet welding requiring more than ten thousand pounds of GENEX, FHP and HTS rod.

M & T can be of help to you . . . Ask for a representative to call and check over your welding operations.

METAL & THERMIT CORPORATION
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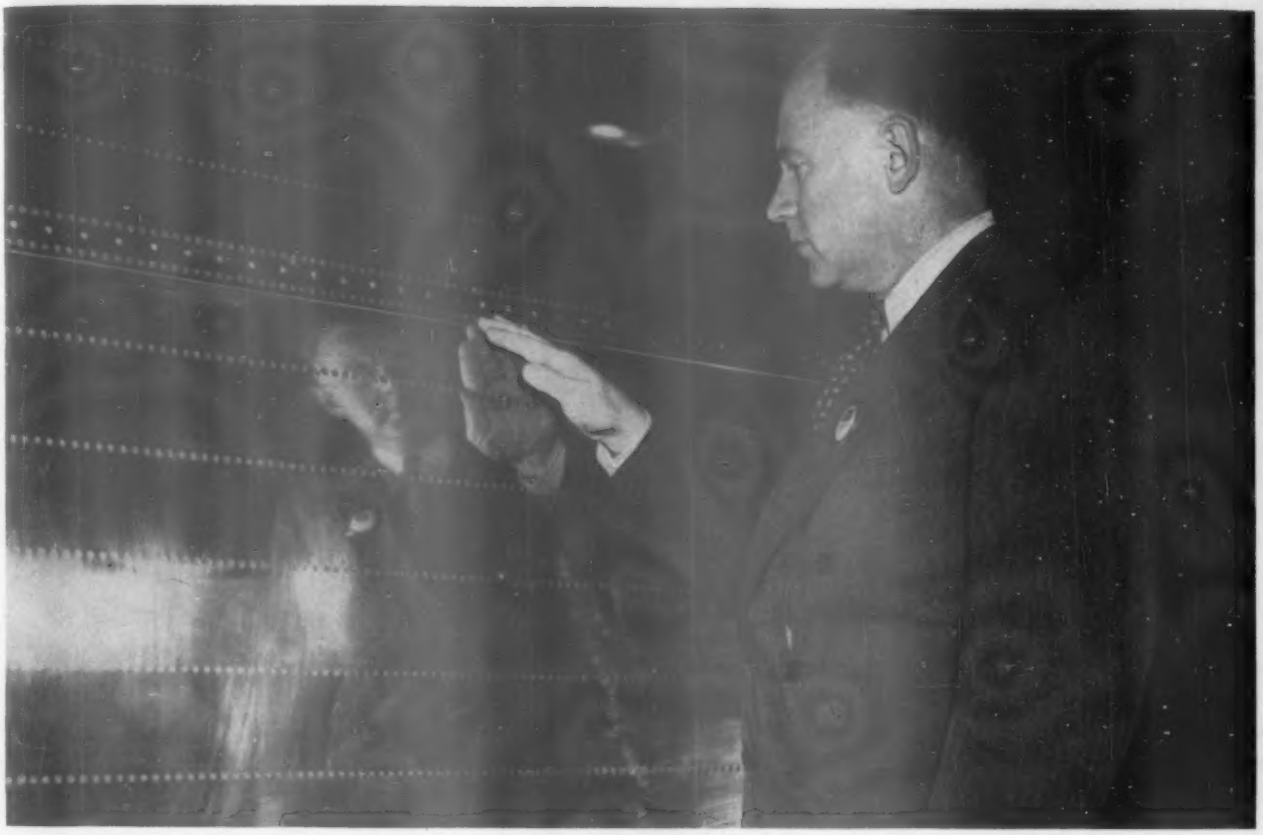


Courtesy Boeing Aircraft Co.

LIKE A MIRROR! Surface of new Stratofreighter is smooth and aerodynamically efficient because of spot welding

1947

Found Welding Again Winning Rightful Place

BY T. B. JEFFERSON

A BIG welding year has just closed. When compared with some of the war years, it was not big from a sales standpoint; neither was it big because of new developments in the industry. Its bigness was due largely to a change in public thinking.

Many of those who accepted welding during the war did so only because they felt it to be a necessary evil, to be taken along with priorities, rationing and directives. They used welding because they were ordered to do so. This group tolerated welding in their fabricating processes not because they liked it but because they had orders to weld in order to conserve material. They looked forward to the end of the war because they knew it would mean the end of such directives, and they could return to their previous methods of metal joining. Let's see what happened to them.

USERS, BIG USERS, OTHERS

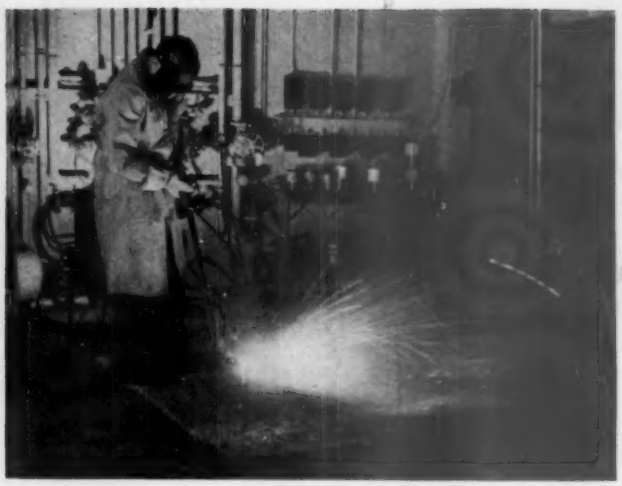
The welding industry was serving three distinct types of customers at the end of the war. First were the old users of welding—those who had used welding before the war and continued it as a matter of course in their wartime production. This group of fabricators came through the war years with greater knowledge of what welding could do. Having always been sold on it, they naturally became more enthusiastic boosters than ever. However, they represent only a part of the story.

Another group represents the expanded users—those who had dabbled with welding in a small way before the war but were forced to expand its applications because of their wartime activities. Having previously known the advantages of welding, they usually took to its expanded use like a duck to water. Reverting to peacetime production, they became even bigger customers of the welding industry.

Third classification consists of those who were introduced to welding for the first time because of their wartime activities and wartime direc-

Courtesy The Linde Air Products Co.

ADDED INERT GAS shields arc in repair of magnesium castings—one of many uses found for inert-gas welding



Courtesy Air Reduction Sales Co

ADDED OXIDIZING AGENT enables the oxy-acetylene flame to scarf stainless-steel slabs to remove defects

New processes speed new products during 1947

tives. Because of the exigencies of war, they were compelled to use welding instead of previous metal-joining means, often to the detriment of equipment they had in the plant. Some, like the customers in our first two classes, readily learned the advantages of welding and became sold on it. Others, however, were reluctant to accept welding because of displaced machines which had not been fully depreciated.

Just as there are string-and-sack savers among individuals, so there are string-and-sack savers in industry. They refuse to give in an inch to modern progress and will cling obstinately to obsolete machinery and obsolete manufacturing methods. The slowness of some organizations to slough off wornout equipment and methods has meant that they were no longer competitors to more progressive manufacturers. In 1947, however, most of them seemed to realize that welding had come to stay, and it was this widespread awakening, coupled with a continued shortage of materials, that made welding big in 1947.

Automatic Welding

Though there were few spectacular developments in welding equipment, there were some advances that will have a marked effect upon the future of welding. The most important of these were in connection with the submerged-melt welder. We can recall three big forward steps in automatic welding.

A manufacturer of hard-facing equipment has developed a complete line of hard-facing electrodes to be applied by submerged-melt welding. The combination will greatly increase the use of hard-facing, especially on new equipment. When hard-facing can be applied automatically, it immediately becomes a production process that manufacturers of farm implements, construction equipment and other heavy earth-moving machinery may use to protect their new equipment against the ravages of wear.

Another application of submerged-melt welding developed in 1947 placed this welding method in the semiautomatic category. This is a small-size, lightweight welding head which may be held in the operator's hand. The welding wire is fed automatically from a reel, attached to the machine, and the granular flux is carried in a container adjacent to the head. Though feed and arc length are automatic, speed and direction are not, permitting the weldor to determine the size of the bead and its location. Aided by such equipment, manual welding may be done at the speed normally accomplished by automatic means.

Shape welding is the third important development of submerged-melt welding to be announced during the year. Since the applications of this process are fully described elsewhere in this issue (page 36), they will not be reviewed here.

Inert-Gas Process

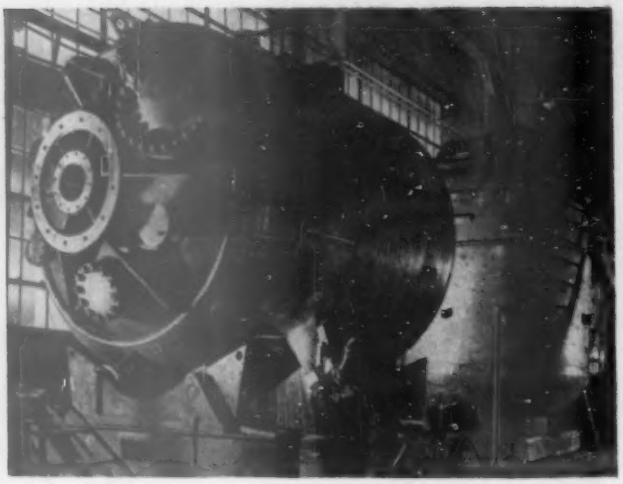
Inert-gas-shielded arc welding was put to further uses during the year in the welding of aluminum and stainless-steel products. Continued experiments have been carried on with both argon and helium used as a shielding medium. It has been found that approximately double the volume of helium is needed; nevertheless, this gas can compete economically inasmuch as its prevailing delivery price is about half that of argon.

Helium has been found especially applicable to automatic inert-gas arc welding since it can be readily used with electronically controlled equipment. Inasmuch as the arc voltage in argon is almost constant throughout the working range of arc lengths, this gas cannot be used in connection with automatic applications which depend on changes in arc voltage for control.

The big advantage of argon, however, is that it enables the hard-to-weld metals such as aluminum to be joined without flux. Fluxless aluminum welding has been found particularly advantageous in applications where flux introduces the possibility of corrosion or rigid specifications do not permit its use. The elimination of fluxes and their inherent cleaning difficulties has definitely developed a place for inert-gas arc welding in the joining of most nonferrous materials. Where flux is not

Courtesy Douglas Aircraft Co.

LITTLE TANKS of aluminum are welded with oxy-acetylene flame on a production basis at aircraft plant



Courtesy A. O. Smith Corp.

BIG TANKS of steel contain many pieces to be joined by arc welding—note these intricate pressure vessels

objectionable, however, aluminum and other non-ferrous alloys may be readily welded by many other processes.

Arc Torch, Flame-Cutting

The carbon-arc torch came into more widespread use in connection with a-c farm welders. This type of equipment allows its user to do a job of arc welding that is more nearly akin to gas-welding technique than most of the arc-welding applications. The higher concentration of heat from the arc torch and the ease of its control make it possible for a relatively unskilled weldor to do many difficult jobs which, with the metal arc, would be next to impossible for other than the skilled arc weldor. In many instances the arc torch has sold the farmer on buying an arc welder to maintain his implements.

The oxy-acetylene flame has continued to find new uses in flame-cutting and pressure-welding applications. Continued refinements make it possible to flame-cut a piece of metal as cleanly as if it were cut with shears. The year's important advances, however, were in the cutting of hard-to-oxidize materials. By introducing various oxidizing agents into the cutting-oxygen stream, or into the flame, these materials can now be severed easily.

Most important applications of the powder-cutting processes have been found in the severing of stainless steels, the most widely used of the oxidation-resistant metals. Stainless steel has become an increasingly important alloy in industrial production and fabrication. Years of research have been devoted to developing new uses for it, some of which were hampered by the difficulties involved in shaping. These difficulties have now been largely overcome by further refinements in the development of processes and apparatus which introduce an oxidizing agent into the oxygen stream or flame. The oxy-acetylene reaction will then provide the necessary heating, melting and fluxing to remove the refractory chromium oxide.

In metal spraying, the oxy-acetylene flame has been combined with a plastic-impregnated wire to make possible the application of hard-facing by metallizing. The plastic wire, containing tiny particles of hard-facing material, is consumed during the process so that only the hard-facing particles are sprayed onto the part being surfaced. Using an ordinary metallizing gun, it is possible to apply an extremely thin layer of protective overlay—so thin, in fact, that it could not be deposited by any other overlaying process.

Powder Welding Improved

During the past several years, hard-facing materials have also been applied by the powder-welding process, which likewise uses the oxy-acetylene flame for overlaying. Further developments in powder welding have now resulted in the feasibility of applying plastics, glass and rubber to metals by this process. This accomplishment will undoubtedly open new fields for the welding industry by making it possible to repair defects in rubber-lined or glass-lined tanks by means of the oxy-acetylene flame. Hitherto, such expensive items have had to be discarded when imperfections were found in them.

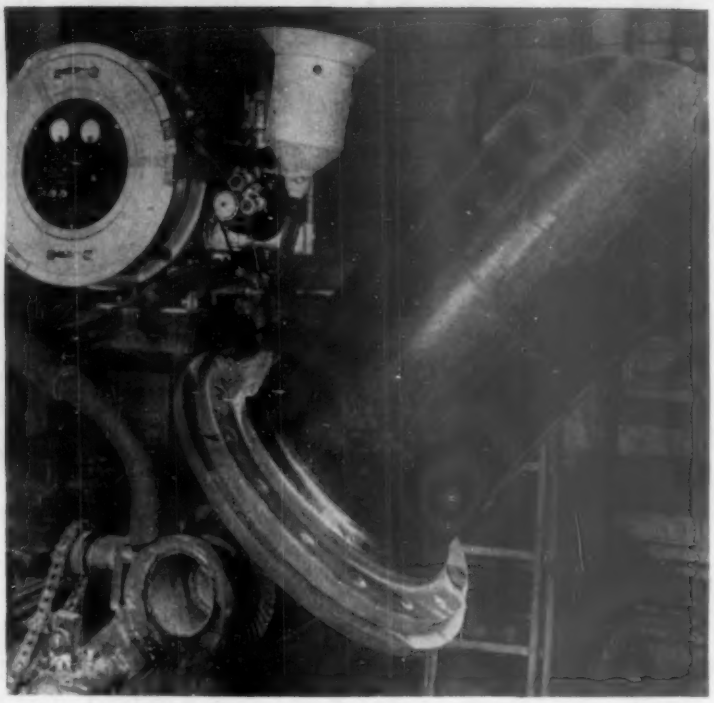
More Pressure Welding

Pressure welding on railroad and pipe lines continues to expand. There are now hundreds of miles of oxy-acetylene pressure-welded rails and possibly even greater mileage in pressure-welded pipe lines. A new development in this type of welding, still in the experimental stage, differs from the customary pressure-welding application in which bonding takes place while facing edges are in a plastic or "solid-phase" condition. In the new pressure-welding process, known as fusion pressure welding, the bond is made while the edges are molten. This is claimed to present the advantage of enabling two pieces to be welded without edge preparation other than having been cleaned of scale and rust. To date, only very thin materials have been welded by this technique, but all indications lead one to believe that heavier pieces will soon be joined.

Resistance welding continued to find new applications in new industries throughout the year. The most startling development was probably the kinetic-energy welder, which was introduced late in the year. Based on one of the oldest principles of

(Continued on page 79)

1—STRAIGHT-LINE welding, longitudinal seam



2—CIRCLE is achieved by rotating large pipe on a positioner

Shape Welding by Submerged-

BY J. A. KRATZ
Engineer, Unionmelt Division, The Linde Air Products Co.

Continuous machine welds can be made to follow prescribed outlines by the simple expedient of mounting a submerged-melt head on the template-guided carriage of an ordinary shape-cutting machine

A NUMBER of special conditions must be taken into account when considering the application of the submerged-melt process to mechanized shape welding, in which the direction of the weld changes as the welding action proceeds. First, the welding zone must be maintained in a horizontal plane because of the large pool of molten metal characteristic of submerged-melt welding. The welding rod must be maintained in the plane of the centerline of the weld, and it must travel at uniform linear speed with respect to the work surface, regardless of the shape of the workpiece. The manipulating equipment must also be designed and coördinated to meet the conditions of automatic welding.

There are, in general, three kinds of continuous machine welds: straight-line, circular and irregular. Straight-line welding is performed either by moving the welding head along the line of work or by moving the work past a stationary welding head. The welding of the longitudinal seam of a tank is an example of straight-line welding in which a mechanized carriage transports the welding head at the proper speed over the work. This is shown in Fig. 1.

CIRCUMFERENTIAL WELDING

An example in which the work is moved past a stationary welding head is found in the circumferential weld made to join the dished head to the shell of a large pressure vessel. In this instance, the circular butt weld was made by rolling the section under a stationary head. Circular fillet welds may also be made by rotating the assembly on a positioning mechanism under a stationary welding head. An example of this method is shown in Fig. 2, where a flange is being welded to large-sized pipe.

The examples of straight-line and circular welding just given are fairly simple, and the methods and equipment for making them not unusual. For the production of welds of irregular shapes, other methods and equipment are necessary. A machine is needed that can follow any given outline. Machines of the type used for oxy-acetylene shape-cutting offer an ideal arrangement since they are made to guide a torch at a uniform speed over almost any pattern. A welding head can readily be mounted on one of these machines, and welds of various contours made with a template for a guide. The laboratory set-up shown in Fig. 3 illustrates how it is done.

In straight-line and in most cir-

3—SPECIAL SHAPES are welded by using a template to guide head to desired contour, as in flame-cutting techniques

d- Melt Process*

cular welding, the welding head is stationary or it moves in a single straight line. In shape-welding, the head must move in at least two and sometimes three dimensions. Shape-welding includes: (1) the making of circular welds in the flat plane where it is not desirable or possible to rotate the weldment, (2) irregular shapes in the flat plane and (3) circular or irregular shapes on curved surfaces.

The method used to make circular welds in the horizontal plane will depend on the size of the weldment. In the welding of large circular pieces, the carriage can be guided by the workpiece itself. An example of this method is the welding of a circular girder. The regular carriage guide wheel was toed in, tending to force the carriage against the flange. An additional guide wheel fastened to the carriage rolled on the inner flange and kept the carriage a specified distance from it. The same method was used for welding the outer flange.

When the circular welds are somewhat smaller in diameter, the familiar method employed in circle cutting may be used. A radius rod or bar is fastened to the carriage and pivoted at the center of the workpiece to determine the radius of the circle the carriage will describe. As an example, this method was used successfully to join the web to the flange and hub of a wind-tunnel fan-center assembly.

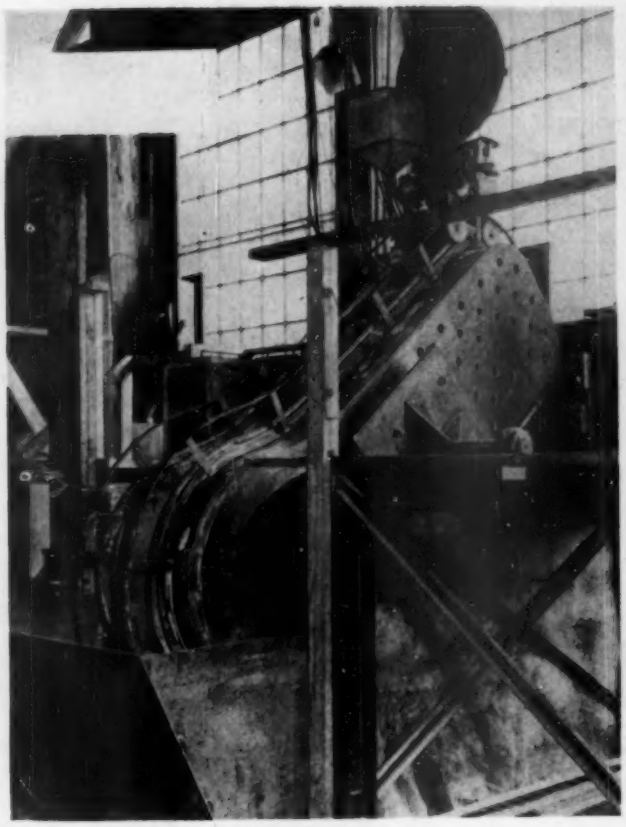
For very small pieces, the welds can be made by using a motor-driven eccentric pin to swing the welding head in a circle. An example of this method is the fabrication of large-size link chains. The welding head supporting hinge was unlocked so that the head could swing free, and the carriage drive was put in neutral so that the eccentric pin could drive and guide the welding head in a circle. The bushings of the chain were welded to the side pieces of each link by 3-in. diameter circular welds.

An adaptation of the template method is the making of a square weld to seal the end of marine boiler headers. The welding head was mounted on a specially built carriage, which rolled forward and back on one pair of rails. The rails were bolted to a truck, which rode on a lower set of rails and thus provided freedom in the lateral direction. A magnetic tracing unit attached to the underside of the carriage followed the square template on the table. The welding head was thus driven at constant speed over the square outline required to seal the end of the header.

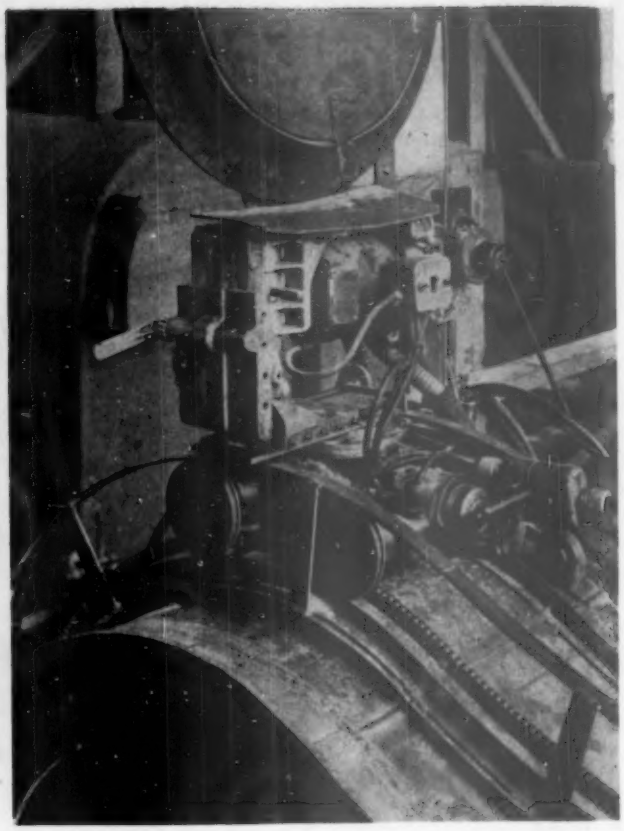
Oval Welds, Too

A manufacturer in the central states employs a standard machine to weld oval ends to the shells of domestic fuel-oil tanks. He uses a strip template to guide the welding head. The cylindrical shells are pressed into a flattened-oval shape, and the flanged ends are manually tack welded into place. The assembly is moved to the welding station and clamped in position while edge welds seal the ends to the tank. The clamping fixture

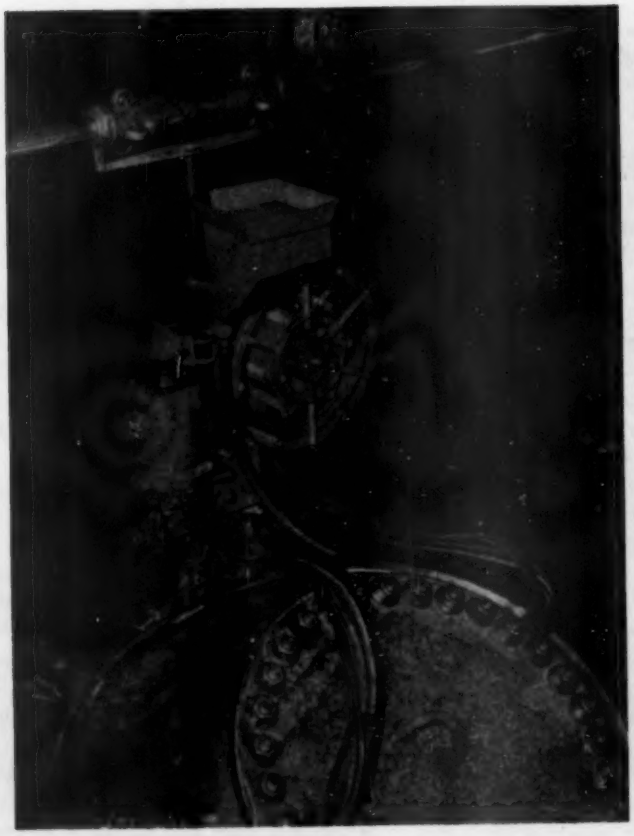
*Abstract of paper presented at the annual meeting, American Welding Society, Chicago, Oct. 18-24, 1947.



4—TRACK FASTENED TO SHELL of a Scotch-type marine boiler guides the head up and down as it travels



5—CAM-CONTROLLED SWITCH controls the positioning of boiler so that welding zone is always horizontal



6—SUPPORTED FROM ROD, head is free to follow the welding vee as it joins dome to a locomotive boiler

7—INSIDE BOILER, welding head is likewise supported on movable sleeve and guided to make inside weld

Automatic heads can move freely in three dimensions on curving surfaces such as high-pressure boiler shells

also serves as retainer for the welding composition.

When Surface Isn't Flat

The problem of making shape welds on a surface that is not flat is principally that of synchronizing the position of the weldment with the equipment that supports and moves the welding head. The outline and size of the piece being fabricated will determine the method that must be used.

When an irregularly shaped piece is rotated under a welding head in a vertical plane, two problems are at once evident: First, the weldment must be rotated at varying speeds since the linear speed will vary as the distance from the center of rotation. Second, the irregular outline compels the welding head to travel horizontally and be free to move vertically.

One method of solving these problems is shown in Fig. 4. The equipment was set up to weld strips and side plates to the shells in fabricating a large number of Scotch-type marine boilers. To insure constant speed, the welding head was supported on a mechanized carriage. Angle-iron track was fitted and tacked to the surface of the shell. The carriage drive was obtained by a sprocket, mounted inside the carriage, which engaged a link chain fastened to the shell. A trunnion mounting supported the entire boiler and provided rotation in the vertical plane. A variable-speed motor automatically positioned the boiler so that the welding zone was always horizontal.

A close-up of the welding equipment appears in Fig. 5. A cam-controlled leveling device mounted on the carriage controls the operation of the positioning motor. Guide rollers ride the welding vee behind and beneath the main cable coupling. A completed weld is shown in the foreground.

So far, the only welds that lie in both the horizontal and vertical plane are those in which a circular piece is joined to a larger cylindrical piece. The welding of manhole rings to tank car casings is an example. In this type of weld the problem is to provide the head with vertical movement while it is driven in a circle of the proper diameter. The ring was tacked in place and supported from beneath by jacks. A centerpost support was then bolted to the manhole ring to support the welding head.

The carriage was lifted vertically by a roller, positioned diametrically opposite from the welding head and riding on the shell of the tank. To assist the mechanical lift thus obtained, the welding head was supported on a piston over the centerpost. A three-way pilot valve admitted air to the cylinder and alternately raised and lowered the welding head as it passed over the contour. A variable-speed motor and gear reducer drove the welding head through a ring gear bolted to the base plate. The vertical travel was approximately 1⅛ in.

It should be noted that the entire tank shell was rolled back and forth as the welding head traveled around the ring so that the welding puddle had no tendency to roll out on the lower sides of the ring.

Domes to Boilers

The welding of domes to locomotive boilers presented a similar problem, but it was solved in a different way. Instead of being supported on a central piston, the welding head rested on the work surface. It was tilted in the vertical position and mounted on a small drive unit, as shown in Fig. 6. A vertical post and roller sleeve, riding on a horizontal rod, supported and steadied the welding machine in the vertical position and also supplied the longitudinal motion necessary. As in the previous example, it was necessary to position the boiler under the welding head to keep the welding zone horizontal. A guide-wheel roller, riding in the welding vee, guided the machine.

After completing the weld from the outside, the apparatus was transferred to the inside of the boiler, and rod track was tacked in place to guide the welding machine. Fig. 7 shows the head inside the boiler and also the manner of bracing the overhead support to the walls of the boiler shell. The entire welding machine was free to turn about the vertical support. A small grooved guide wheel, mounted a few inches behind the large drive wheel, kept the welding machine in line.

Seven Shape-Welding Methods

(1) For large circular welds, when it is not practicable to use a radius rod, the carriage can be driven in a circle by guide wheels resting on such natural guides as hubs or flanges.

(2) For smaller flat circular welds, the carriage can be driven in a circle by the use of a radius rod. It is necessary to support the carriage on the work surface when making welds of this size.

(3) An eccentric pin can be used to drive the welding head in making very small circular welds. The minimum radius is limited only by practical consideration. The maximum radius practicable with this device depends upon the lateral swing of the arm on the carriage.

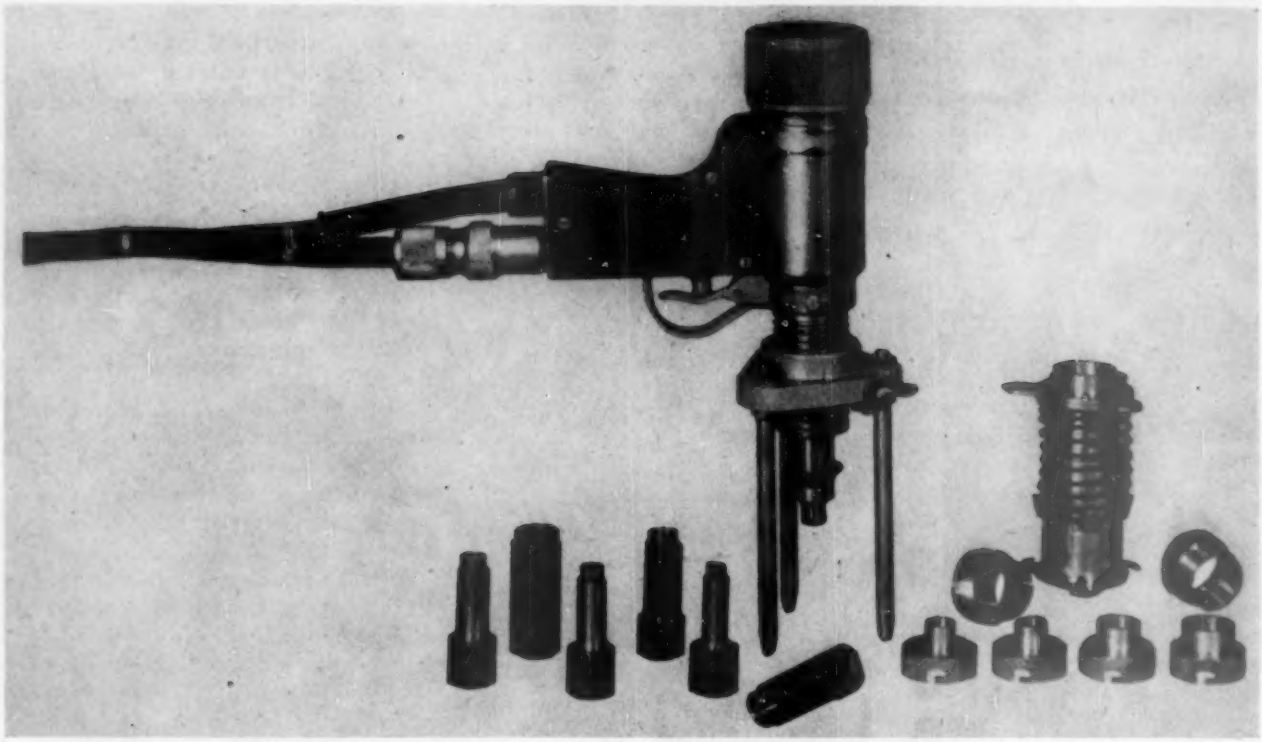
(4) For flat welds of irregular shapes, the use of a template-following machine is recommended. The size of the weld is limited by the capacity of the cutting machine.

(5) For welds that lie in the vertical plane, the simplest equipment consists of a track to guide a mechanized carriage over the work surface. A positioning motor must be used to keep the welding zone horizontal. In this case, the size of the work has a lower limit in relation to the size of the welding machine.

(6) The work surface can be used as a cam to raise and lower the welding head in making welds that lie in both horizontal and vertical planes.

(7) Another method for making horizontal-vertical welds is to support the welding head separately for longitudinal movement while the workpiece is being rolled under it to provide lateral travel. Guiding is obtained by the welding vee or by a rod track tacked to the work surface.

As welding engineers come to realize the possibilities of shape welding, there will undoubtedly be many other applications, and, of course, some totally new methods will be devised to solve special problems of guidance and positioning. The principal factors that will determine the method will be the shape of the weld, the size of the weldment and the number of units to be made.



GUN FOR STUD WELDING developed by a British manufacturer. Component parts include a spring-loaded chuck

Stud Welding i

Equipment developed in Britain to arc weld steel studs to steel plates much resembles stud-welding guns of the United States. Ignitron tubes provide rectified d-c for the welding current

BY A. H. BENT

Manager of the Welding Department of English Electric Co., Ltd.

A DEVELOPMENT of the arc process to stud welding was recently demonstrated by the English Electric Co., Ltd., at Yoker, Scotland. The principle is not new in America, but to Britain it is a practical application of established principles that is likely to effect savings in time and costs. Ability to arc weld studs to plates and structures obviates drilling, tapping and inserting of the bolt or blanking of the plates and bolting through—also welding around the head of the bolt when sealing is required against gas, oil, water, etc.

The requirements governing the efficient execution of the operation of affixing the studs are:

(1) The stud should be exactly positioned and welded vertically to the plate.

(2) The joint between the stud and the plate must be homogeneous; in many cases it must also be gas or water tight.

(3) The mechanical strength of the weld must at least equal that of the stud material.

(4) Speed is important as in many cases a considerable number of studs will have to be fixed on one structure.

(5) The equipment should be suitable for operation by semiskilled labor: it should be robust, suitable for outdoor service and reasonably portable.

An automatic stud-welding equipment which will fulfill the above requirements has been developed in recent years by the English Electric Co., Ltd.

PRINCIPLES OF OPERATION

A specially constructed gun tool enables a stud to be located in a special chuck. Three adjustable legs make it possible to locate the gun accurately so that the stud will be truly vertical to the work at the point of welding. A refractory ferrule surrounds the base of the stud and the weld area to exclude impurities from the atmosphere and confine arc flash and splatter.

The only hand operation required by the weldor is to press a trigger. The stud is then affixed to the parent metal in an automatic operation taking less than one second. Several similar studs, therefore, can be welded each minute.

The studs are manufactured of mild steel and stocked in various lengths with both Whitworth and British Standard fine threads. Sup-

BRITISH SHIPYARDS find the process easy to apply

TRANSFORMER CASE is a product using welded studs

g in Great Britain

plies are also available of the associated refractory ferrules. Each stud embodies a small, accurately dimensioned pip at the welding end, function of which is to initiate the arc.

The chuck in which the stud is held is spring-loaded, the spring being released by an electrical device located in the gun tool. When the switch-trigger is pressed, the stud is pushed against the plate to make contact and then held in suspension while the pip is fused by the passage of the welding current. Arcing takes place for a predetermined time, at the end of which the stud is plunged into the molten pool to make a perfect weld. The whole operation is completed in such a short time that there is no distortion, even when studs are welded to thin plates.

The above operation is controlled automatically by means of a special mechanical timing device mounted in the current regulator cabinet. A relay, whose source of d-c supply is provided by an auxiliary transformer and rectifier, starts a small timing motor. This motor, operating through a reduction gear, drives a shaft on which a number of cams are working in sequence. The cams open and close auxiliary switches, so forming the basis of the timing function.

Once the motor is set in motion, it must continue to rotate until the whole operation is completed, thus taking the control out of the hands of the operator. Even if the trigger switch is pulled again during the welding operation, the timing mechanism will not respond; hence a double weld cannot be made.

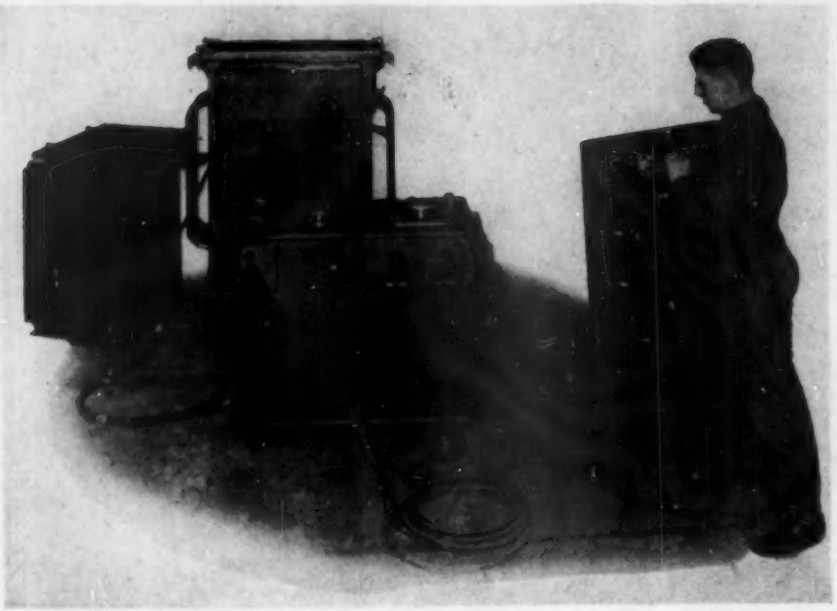
Current Rectified

The stud-welding equipment described operates from rectified alternating current. The welder is connected to a standard source of low-voltage 50-cycle a-c supply, and a double-wound transformer steps the pressure down to a secondary voltage of approximately 100 volts. The secondary voltage is then applied to a rectifying medium to produce unidirectional current, the output being adjusted by a current regulator.

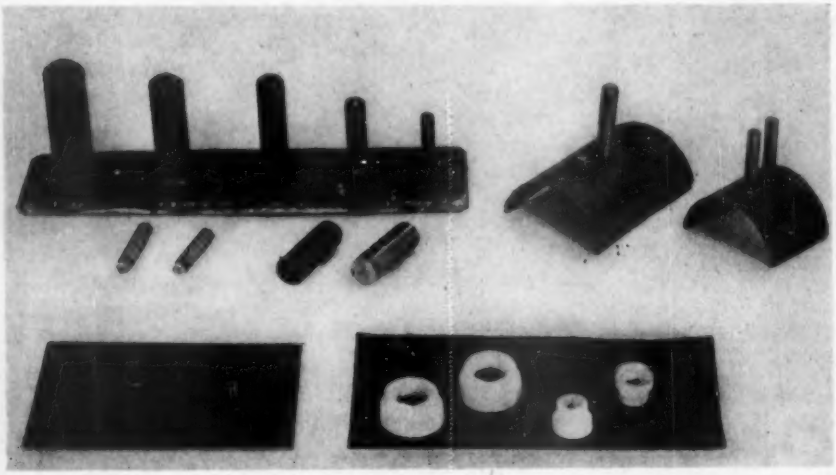
In the case of large equipments, suitable for welding studs from ¼-in. diameter up to ¾-in., the power supply is taken from the three-phase mains, through a step-down arc-welding transformer with a rectifying bank and a current regulator. The smaller equipment, capable of welding studs up to ⅜-in. diameter, is suitable for use with a single-phase supply.

Ignitrons form the rectifier medium, and these are oil-immersed and protected in steel tanks. In the same tanks, in separate compartments, is the auxiliary equipment for operating the ignitrons through the timing circuit.

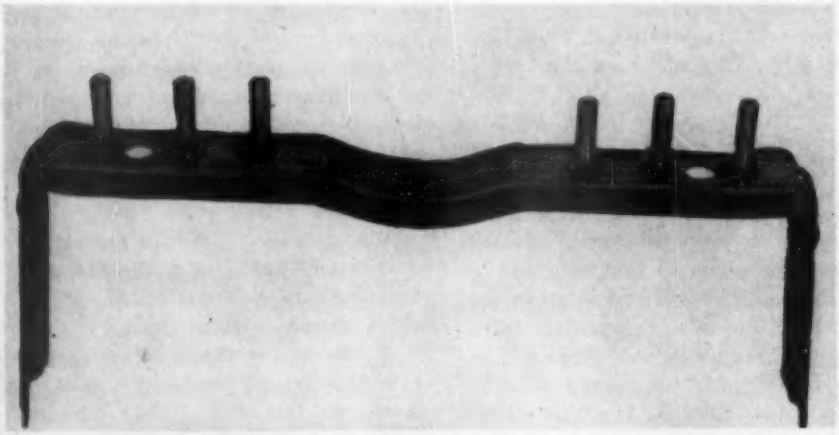
A switch on the current regulator enables the operator to obtain the correct value of current for the various sizes of studs, and the timing mechanism is also controlled by a switch giving various timings for the diameters of studs being used. These switches are operated from the outside of the tank. The current values and timing positions are marked in stud sizes and clearly indi-



LARGE STUD-WELDING OUTFIT includes current regulator, step-down transformer, rectifying ignitrons, suitable length of cable and the welding gun



CURVED PLATES are no bar to use of stud welding. Note various sizes of studs and the refractory ferrules that insulate the welding operation



WITHOUT DISTORTION, six studs are welded to top of this thin stamping

cated. The current required for a given size of stud is obtained by adjustment of a rotary tapping switch. The timing operation is easily preset by means of a rotary handle on the timing mechanism, and it resets automatically at completion of the cycle.

Why Direct Current?

One of the main reasons for using direct current for the welding operation is to reduce the high reactive voltage drop (particularly in the leads to the actual gun) which occurs with alternating current. This advantage applies especially when larger sizes of studs are welded. Furthermore, non-ferrous studs, *i.e.*, brass, can be welded to steel plates with this d-c equipment.

From the maintenance point of view, it is important to note that no primary contactors are used, the rectifying ignitrons fulfilling the functions of both rectification and isolation of the circuit.

The large stud-welding equipment can be operated from any type of 300-amp arc-welding transformer having a secondary voltage of approximately 100 volts, phase to neutral. This transformer feeds a separate rectifier bank and welding regulator.

The smaller equipment is a single-phase combined set; transformer, rectifying bank, timing equipment and all auxiliaries are contained in a single housing.

A third unit (which is mounted on wheels) comprises the current control regulator and the timing device. It is admirably suited to shipyard work as the transformer and rectifier can be on shore or at ground level while the control unit and welding gun are taken onto the deck. This complies with British regulations concerning voltages allowed on a ship; namely, circuit d-c at approximately 100 volts. When using 0.15 sq in. cable, $\frac{5}{8}$-in. diameter studs can be welded 200 ft from the transformer; $\frac{3}{4}$-in. diameter studs reduce the distance to about 120 ft; smaller sizes such as $\frac{1}{4}$ in. may allow up to perhaps 500 ft.

Two-gun operation may be provided by using mechanically and electrically interlocked contactors on the secondary side to prevent simultaneous operation of both welding guns.

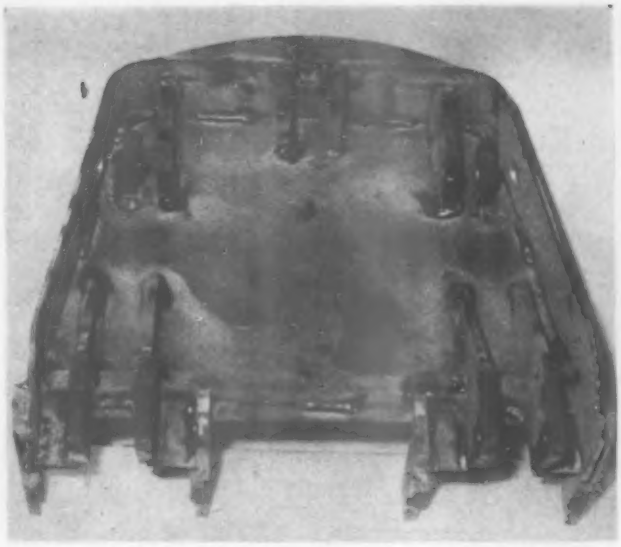


Fig. 1—The welded steel saddle for the lift truck. A total of 26 separate components had to be assembled

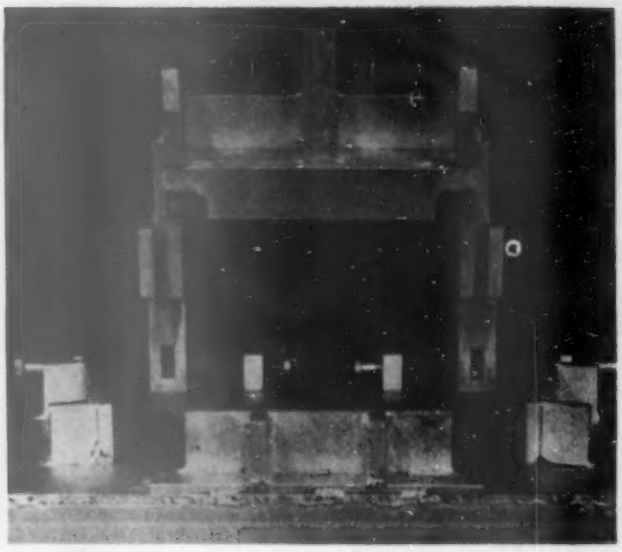


Fig. 2—Assembly was done in this special jig, designed and built by Turrill, Inc., of Cincinnati

Weight Saved: 20%

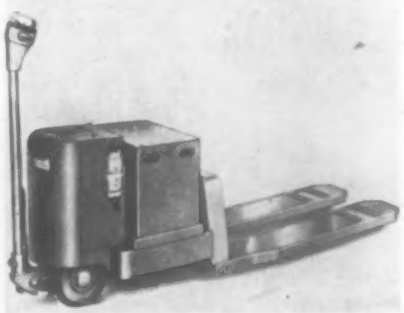
Weld fabrication of a saddle for the lifting frame of a pallet-type lift truck saves weight, cuts machining costs

WELDED steel fabrication with the aid of a properly designed jig enabled Lift Trucks, Inc., Cincinnati, to save approximately 20% in weight and 75% of the machining costs incurred in the manufacture of the company's new front-wheel drive pallet-type lift truck. Likewise the warpage and distortion experienced with former materials were eliminated—the real reason behind the decision to redesign for welded construction.

SADDLE COMPONENTS

Welded steel fabrication is being employed on the frame chassis, saddle and front and rear hoods of the lift truck. The particular part which demonstrates the advantages of welding, however, is the saddle (Fig. 1). The saddle is the main forward member of the lifting frame through which the truck load is lifted. It comprises 26 separate parts, flame-cut from 3/16-in. to 5/8-in. plate or sawed from bar stock. These parts are: 1 front plate, 1 cover, 1 upper reinforcement, 1 lower cross bar, 2 upper bearing lugs, 4 mid bearing lugs, 4 lower bearing lugs, 2 outer rail plates, 2 inner rail L-plates, 4 vertical reinforcements and 4 rail angles.

The key to the successful welded assembly of these many odd-shaped parts is the jig shown in Fig. 2. Also of welded construction, this jig held the component parts of the saddle so accurately during welding that the only machining necessary was to ream the holes for attachment.



Photos courtesy The Lincoln Electric Co.

Pallet-type lift truck redesigned for welded construction. Warpage and distortion couldn't be eliminated with materials formerly used

Assembled and accurately located in the jig, the component parts were tack welded together with E-6012 all-position electrodes 1/8 and 5/32-in. After tacking, the saddle was removed from the jig for finish welding.

COST COMPARISON

With the former materials, use of which was resulting in distortion and warpage, the cost ranged between $32 and $35 per saddle, plus a pattern cost of approximately $300. On the first 25 weld-fabricated saddles, (finished), the cost per unit was $32, plus the fixture cost of $125. Welding thus fully held its own from the cost standpoint. Moreover, as previously stated, weld fabrication eliminated approximately 75% of the machining on the part.

In addition to the front-wheel-drive, pallet-type lift truck on which these interesting results were obtained, the company manufactures 1,000-lb to 5,000-lb "single" mechanical-type lift trucks and 4,000-lb to 6,000-lb hydraulic and electric types.

8 — SUCCESSFUL WELDING DISTRIBUTOR OPERATIONS

Welding Stores

Purity Cylinder Gases gets a lot of business by sending out trucks on regular milk routes. Each truck constitutes a miniature welding store

BY CLYDE B. CLASON

A TOSS of a coin determined who should be president of Purity Cylinder Gases, Inc. And—even more remarkable, perhaps—the two losers were as well satisfied with the decision of chance as the winner.

The story of this successful Michigan distributorship begins some nine years ago when Michigan Gases, Inc., was absorbed by the Compressed Industrial Gas Co. (later taken over by the National Cylinder Gas Co.). Three young men who had been working for Michigan Gases decided that the time was ripe to better their business future. In October, 1938, they launched their venture by opening offices simultaneously at Grand Rapids and Kalamazoo.

ODD MAN PRESIDENT

These men were Edward Butterfield and Howard Sweet, who had been salesmen for the old Michigan Gases, and Glenn G. Garman, who had served as office manager. Friends of long standing, they had so little respect for the prestige of office holding that they tossed coins to see who should be president. The odd man who won was Howard Sweet. Garman and Butterfield promptly elected themselves vice-presidents and matched again to see who should be treasurer (Butterfield) and who secretary (Garman).

Though incorporated from the start, Purity has always been run more in the manner of a partnership than a corporation. Each of its officers has an equal voice in the management, and no major decision is ever reached unless all three men are in substantial agreement. The three founders have remained the

MERCHANDISE is attractively displayed in showcase at Grand Rapids store

ELEVATOR TRUCK facilitates handling of heavy cylinders. Tail gate drops horizontally to become an elevator which can handle a load up to one ton

NEAT TRUCK BOXES carry welding rods and accessories out to customers

Go on Wheels

REPAIR DEPARTMENT, centralized at Grand Rapids, stocks spare parts for all well known makes of oxy-acetylene welding and cutting equipment

closest friends, and the smooth way in which they work together is a delight to behold. President Sweet has general supervision over sales and devotes most of his time to the branches outside of Grand Rapids. Vice-presidents Garman and Butterfield are both located at the Grand Rapids headquarters at 574 S. Division Ave. Garman handles credits, collections, accounting and legal matters, while Butterfield takes care of purchasing, advertising and general operation.

More Business, More Branches

As the company's business began to grow, new branches were added. The Lansing office was opened in June, 1940, and in September, 1941, the Warsaw Welders' Supply Co., of Warsaw, Ind., was purchased and absorbed. The fifth branch office will shortly be opened at Benton Harbor, Mich., where a new building is under construction and is expected to be ready for occupancy within 60 to 90 days.

The Benton Harbor branch will round out the company's trade territory to a quadrangle bounded on the west by Lake Michigan, on the north by a line thirty miles or so north of Grand Rapids, on the east by a north-and-south line just east of Lansing, on the south by north-central Indiana. This area is approximately 85 miles east and west by 175 miles north and south. It will thus be seen that most of the expansion has been in the north-south direction. Lake Michigan has halted westward expansion, and growth to the east has been checked by the competition of the Detroit area.

The Michigan - Indiana territory served by Purity is well diversified. Northward is a good concentration of heavy industry at such centers as Grand Rapids, Kalamazoo and Lansing. The southern section is almost entirely agricultural except for such fringe cities as South Bend and Elkhart, Ind. Industrial customers represent well over 50% of the company's dollar volume, though accounting for only 10% of its total number of customers. Job shops and garages deliver about 45% of the sales volume and 70% of the customers. The farm business now represents only about 5% of the total volume but is growing rapidly.

GRAND RAPIDS is company headquarters. Executive and accounting offices are located in this building

KALAMAZOO office was opened simultaneously with that in Grand Rapids when business was founded in 1938

Purity operates four stores in Michigan-Indiana territory

Starting from virtually nothing, Messrs. Sweet, Garman and Butterfield have been able to build up a million-dollar-a-year volume, including their bottled gas business. That is an enviable accomplishment.

The company handles gas and arc welding supplies and equipment, oxygen, acetylene, carbide, hydrogen, propane and domestic bottle gas and gas appliances. Full lines of products for arc and gas welding were stocked from the first and sold along with the welding gases. Among the items sold regularly are: a-c and d-c arc welders, electrode holders, welding cable, clamps and other arc-welding accessories, fluxes, electrodes, welding rods, acetylene generators, welding and cutting torches, shape-cutting machines, pressure regulators, oxy-acetylene manifolds, welding hose, carbon-arc torches and carbon electrodes, hard-facing rods, silver solders, brazing alloys, diecast welding rods, farm welding outfits, welding textbooks, goggles, eye-shields and helmets.

Such products as fluxes are packaged and sold under the trade name "Purity." Most of the packages are featured by the use of "Purity blue," a light-blue shade which the company has succeeded in identifying with its products.

Related items such as power hammers and grinders are also sold to welding customers. All sizes of grinders are carried, from small portable electric and pneumatic models to large stationary machines for precision grinding.

At least one truck trip is made every day, five days a week, from each office. The drivers covering these "milk routes" take out merchandise to sell customers without previous orders. On this basis, every established customer is visited at least once every two weeks. The system saves greatly in shipping and handling costs and in office paper work. There are about 20 of these driver-salesmen distributing welding gases and supplies.

The company operates 29 trucks, of which six are devoted exclusively to bottled gas deliveries. Trucks used for the delivery of welding supplies are fitted with shelved and partitioned compartments in which welding rods, electrodes, fluxes, safety products and other accessories may be stored. As complete and varied a stock as possible is carried on each trip.

One of the larger trucks has been equipped with a hydraulic hoist capable of handling a load up to a ton. The tail gate simply drops down horizontally and becomes an elevator for the loading and unloading of heavy cylinders. The trial installation has proved so successful that two other trucks are to be equipped with the same type of hoist.

Salesmen are employed to supplement the routine reorders of the truck force. The salesman's primary responsibility is to bring in new accounts. Altogether, there are eight salesmen: three traveling out of Grand Rapids, two out of Kalamazoo, two out of Lansing and one from Warsaw. Not all of these men are expert weldors, but all of them thoroughly understand the various welding processes and their applications.

The men responsible for the success of Purity think it is sometimes an advantage for a salesman not to know how to weld. The man who is an ace with a welding torch just can't resist showing off his skill, whereas the dub weldor will put the equipment into the customer's hands and let him make his own demonstration. And the latter way works out best from the standpoint of sales.

Can you remember the old pre-war days in which there existed men whose function it was to sell automobiles? These experts of a long forgotten profession would edge the prospective buyer into the driver's seat as quickly as possible and let him sell himself on the car's performance. It works the same way with welding equipment, but not so many salesmen seem to realize it.

When a salesman runs into a problem that's too hard for him to handle, he calls upon the company's technical expert, C. W. Sparrow. Mr. Sparrow has laid out welding production setups, including detailed engineering drawings, for some of the biggest industrial concerns in western Michigan. He is available in an advisory capacity for those customers who happen to need technical assistance.

Four Retail Stores

At Grand Rapids and each branch office, Purity operates a completely equipped retail store, with sales clerks on duty all of the day to handle the walk-in trade. Each store is in charge of a district manager. Chester Voorhorst is district manager at Grand Rapids; W. W. McClellan at Lansing; Kenneth Nyhuis at Kalamazoo and Ernest C. Albert

LANSING store and office became operative June, 1940, marking the third point on the Purity quadrangle

WARSAW, IND., office was acquired in 1941 by purchase and absorption of the Warsaw Welders' Supply Co.

at Warsaw. All of these men and also Mr. Sparrow started with Purity as truck drivers and learned the business the hard way by wrestling with heavy cylinders.

The manager for the new Benton Harbor district has not yet been selected, but it is certain that he will be one of the present sales force.

Purity does a comparatively large walk-in business. Store sales account for approximately 15% of its total volume. One general rule is to locate each store close to the center of town, within easy walking distance from the downtown business area. The company also believes in what Mr. Garman terms the "power of selling by sight." Show windows are artistically arranged as are the glass showcases in which smaller items are displayed inside. Every effort is made to see that the walk-in customer is exposed to as many welding items as possible. It works, too, for each store more than pays its cost of operation.

Many cash sales are made to strangers; *i. e.*, individual weldors in big production shops who may not like a particular item of equipment with which they have been furnished and came in to buy their own. Some of them often develop into regular customers. In particular, the management believes in being kind to student weldors, in answering their queries fully and in giving them as much assistance and encouragement as possible. This is not only the decent thing to do, but it is bread cast upon the waters that may be returned manyfold.

Some years ago, for example, a young fellow dropped into the Grand Rapids store to ask a few questions about arc welding. Mr. Garman talked to him and learned that he owned an arc welder of his own upon which he practiced nights. Gathering up an assortment of various types of electrodes, Garman presented them to him with the company's compliments. Today the recipient of that gift is superintendent of a large production-welding shop, and Purity gets every dime of his business.

Another cheap but highly effective way to build good-will is to place old copies of welding trade journals on the store counters to be taken by anyone who wants them. Many good welding ideas are thus passed along.

Stages Welding Clinics

Welding clinics are conducted from time to time for the benefit of customers' customers. Usual procedure is to pick out an alert, aggressive welding shop and ask the proprietor to invite his customers to witness a demonstration of the latest welding methods and equipment. As soon as possible after the date has been settled, formal printed invitations to the event are supplied for the welding shop to send out.

These clinics have proved particularly popular among rural welding customers. Attendance as high as 150 has been recorded, though the average attendance is about half that figure. The demonstrations include hard-facing and other specialized applications, and visitors are sometimes invited to bring in broken equipment to be repaired free. Light refreshments are served afterwards.

The clinics are held during the winter and spring months, never in the summer or at harvest time. Each sales district stages three or four of them a year.

Another sales booster is the repair department, centralized at the Grand Rapids headquarters. This was originally started as a customer service, but the volume of work has so grown that it is now a profitable operation of its own. The department is able to recondition completely all makes of torches and pressure regulators. Spare parts are stocked for all of the better known makes of gas welding and cutting equipment, whether handled by Purity or not. At present one full-time repair man and a part-time assistant are able to take care of all repair jobs throughout the company's territory. Since there is daily trucking service between Grand Rapids and each branch, a minimum of time is lost in transit. Shipping and packing charges are also avoided.

Makes Preheating Torch

Purity manufactures and markets an air-propane torch combination which has many varied uses including preheating, brazing, silver soldering, soft soldering, melting babbitt and bearing metal, lead burning, straightening and bending, descaling and paint removal. This torch is sold both locally and nationally, and a limited amount of trade-paper advertising is done upon it.

The "Vulcan" is a universal torch assembly with two types of handles and five interchangeable tips. No. 1 tip is designed for light, delicate soldering and brazing work such as electrical connections, jewelry manufacture and dentistry. No. 2 is suited for plumbers and piping contractors to silver solder bell and spigot joints on 2½-in copper tubing. No. 3 is a paint-burning tip of approximately the same capacity as No. 2; it produces a ribbon-type flame 2½ in.

wide for the rapid removal of multiple layers of old paint. No. 4, a tip with 2½ times the capacity of No. 2, is used for heating, annealing, bending, forming and also for heavier brazing jobs. No. 5, having 2½ times the capacity of No. 4, is the largest tip of all and is employed in the preheating of heavy castings prior to welding and for spot annealing and other applications where a large volume of heat is required.

Bottled gas is sold to domestic and commercial customers who are located beyond city gas mains. This important division of the business is under charge of Frank Killion, manager of the bottled gas department for all territories. The farm wife who subscribes to the company's service can cook with no more concern over the fuel supply than her city-dwelling cousin. The initial installation consists of two cylinders and a gadget which shifts the load automatically from the exhausted to the reserve cylinder. It is the business of Mr. Killion's department to insure that there will always be a full cylinder on hand when the changeover occurs.

Issues Separate Catalogs

The company's principal advertising expenditure is for its catalogs. These have many points of general interest. "We don't believe in the conventional looseleaf catalog," Mr. Garman explained, "because customers will not keep them up to date by inserting new sheets and making price changes as instructed. Instead of one large catalog, we have found it advantageous to issue separate small catalogs on: (1) welding and cutting equipment (both gas and electric); (2) accessories: (3) electrodes; (4) gas welding wire; (5) supplies such as fluxes, carbide, etc.; (6) eye protection. A separate catalog is also issued on the Vulcan torch. The type for all of the catalogs is kept standing at our printer's, and it is a simple matter to correct it for price changes. We print about 2,500 copies of a catalog at a time and issue a new edition whenever conditions justify it. Though we lose the savings effected by quantity printing, we gain in never having a large amount of money tied up in obsolete catalogs."

Catalog EP on eye protection may be described as a typical example. This is about average in size, consisting of eight letterhead-size pages. The cover page is mostly a large illustration printed in "Purity blue," the light-blue tint previously mentioned. Color is used sparingly on the inside pages, the same Purity blue. Of the inside pages, the first four are illustrated. The pictures—outline halftones of individual welding and chipping goggles, safety shields and welding helmets—are grouped on the outside vertical half of each page. This simple layout trick avoids the patchwork hodgepodge that is characteristic of poorly arranged catalogs.

In addition to its own catalogs, Purity makes good use of manufacturers' broadsides and envelope stuffers. Classified listings are taken in the Grand Rapids, Lansing, Kalamazoo and Warsaw telephone directories, but little newspaper advertising is done except on bottled gases.

One of the most successful pieces of welding literature ever sent out was the "Hints for Successful Welding," written by one of the company's employees seized with a white-hot inspiration. Here are some of them:

"1. Always use a pipe wrench on brass fittings. They just put the hex nuts on to confuse you.

"2. Never wear goggles. They are for sissies, and besides if you get a piece of slag in your eye, what the heck, you only need one eye to see with.

"3. If the nut on your oxygen regulator doesn't go on easily, put some oil on it. The wife and kids probably won't even miss you.

"4. When cutting, never wait to cut all the way through. Just hit it a wallop with the torch head. The people who make and sell torches have to live too.

"5. Welding hose is tough. Hot metal won't hurt it much, and if it gets caught on something, jerk hell out of it. Friction tape will patch it up pretty good.

"6. If you smell a little acetylene, test your generator for leaks with a match. But be sure your parachute is safely buckled on."

This bit of humor really rang the bell with the company's welding shop customers, a good share of whom have tacked the complete set of "Hints" to door or wall.

No Gifts to Customers

All too often the advertising account is used as a dumping ground for business bribery, whether done crudely or in more subtle form such as expensive Christmas presents. Not so at Purity. "Bought business never stays bought," asserts Ed Butterfield. "If a man intimates that he will deliver some good orders provided we can make it worth his while, we just aren't interested. When you go in for that sort of thing, there is always someone with a larger purse to outbid you. Our customers are our friends, but they don't receive presents from us."

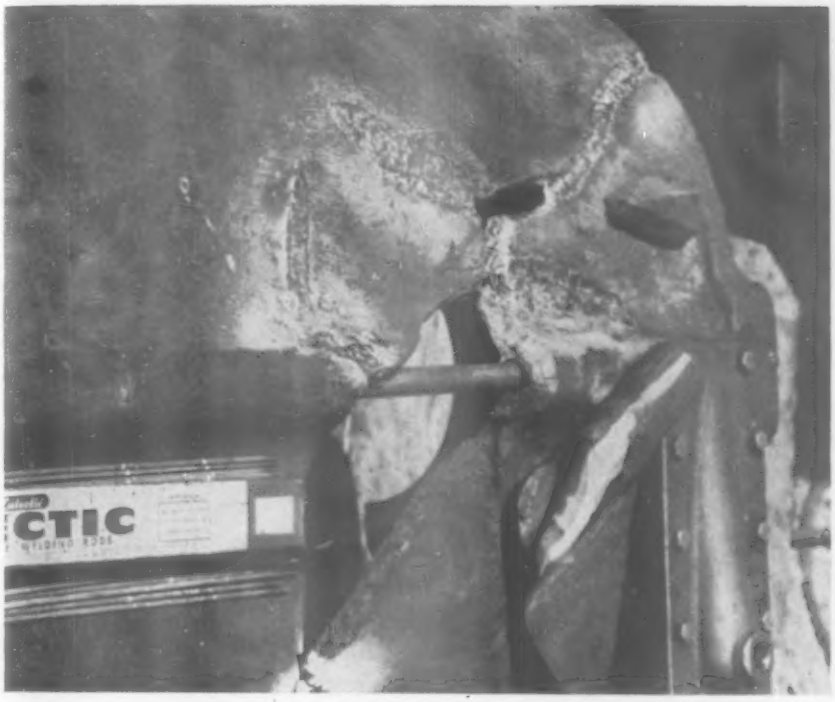
To summarize, frequently traveled sales routes, welding stores on wheels, technical assistance to whatever degree is necessary, educational clinics and the warmhearted personalities of Messrs. Garman, Sweet and Butterfield . . . these are the chief columns upholding the weight of Purity's million-dollar-year business.

Dan, the Old Weldor, Says:

"DON'T GET in trouble from a freeze-up!

"Now that winter is with us, watch out particularly for your acetylene generator. Freezing is bound to harm it, and if an attempt is made to operate a frozen generator and it blows up, mighty serious damage may result.

"Anti-freeze may be used to protect the radiator of the engine-driven welder, but it won't work well in the acetylene generator. A heating coil may be used to avoid freezing, but draining the generator when not in use is the best precaution. When draining a generator, be sure that all the sludge is drained. Also be sure to drain the filter tank and flash-back check valve—they are more apt to freeze than the generator. If you forget to drain the generator and it freezes, then use hot water or steam for thawing—never an open flame."



Photos courtesy Eutectic Welding Alloys Corp.

Fig. 1—A threaded steel rod pulled the broken sections into alignment

Shattered Crankcase

Fig. 2—Completed welds were smooth and machinable. Peening and a light postheat sufficed for stress relieving. The job was done in 48 hours

Salvaged by Welding

Unusual repair made on a two-ton casting for a 300-hp engine restored Northern California dredger to service

USING an improvised preheating arrangement that consisted in leaving a large floodlight in the casting overnight, a Sacramento weldor accomplished a spectacular reconstruction job on a two-ton crankcase, 10 ft long. The crankcase belonged to the 300-hp marine engine of a dredge operating in the Klamath river area of northern California. A broken connecting rod bolt caused the connecting rod to be thrown through the crankcase. Salvage had been pronounced impossible by experts, but a practical weldor's skill restored it to immediate service.

First step in the repair was to align the ruptured sections. Fig. 1 shows how they were held together by passing a threaded rod along the broken oil sump channel. Pulling of the broken edges together was a notable feat in itself since the walls of the heavy casting averaged 1 in. in thickness. The original ruptures did not extend to the end of the casting, and ¼-in. holes were drilled at the end of each crack to prevent it from progressing.

A special 18-in. alloy electrode for welding cast iron at comparatively low temperature was used, and the only preheating apparatus necessary was the floodlight previously mentioned. A number of passes were made, consuming a total of 30 lb of electrodes. Welds were made both inside and outside to restore the broken oil channel.

The smooth finish of the welds, noticeable in Fig. 2, was achieved by using the lowest possible amperage to minimize fusion and prevent the base metal from melting. The welds were peened, and a slight postheat was used to stress relieve the finished sections.

The entire welding operation required 48 hours. Normal replacement of this crankcase would have taken three months and would have likewise entailed suspension of extensive dredging operations.

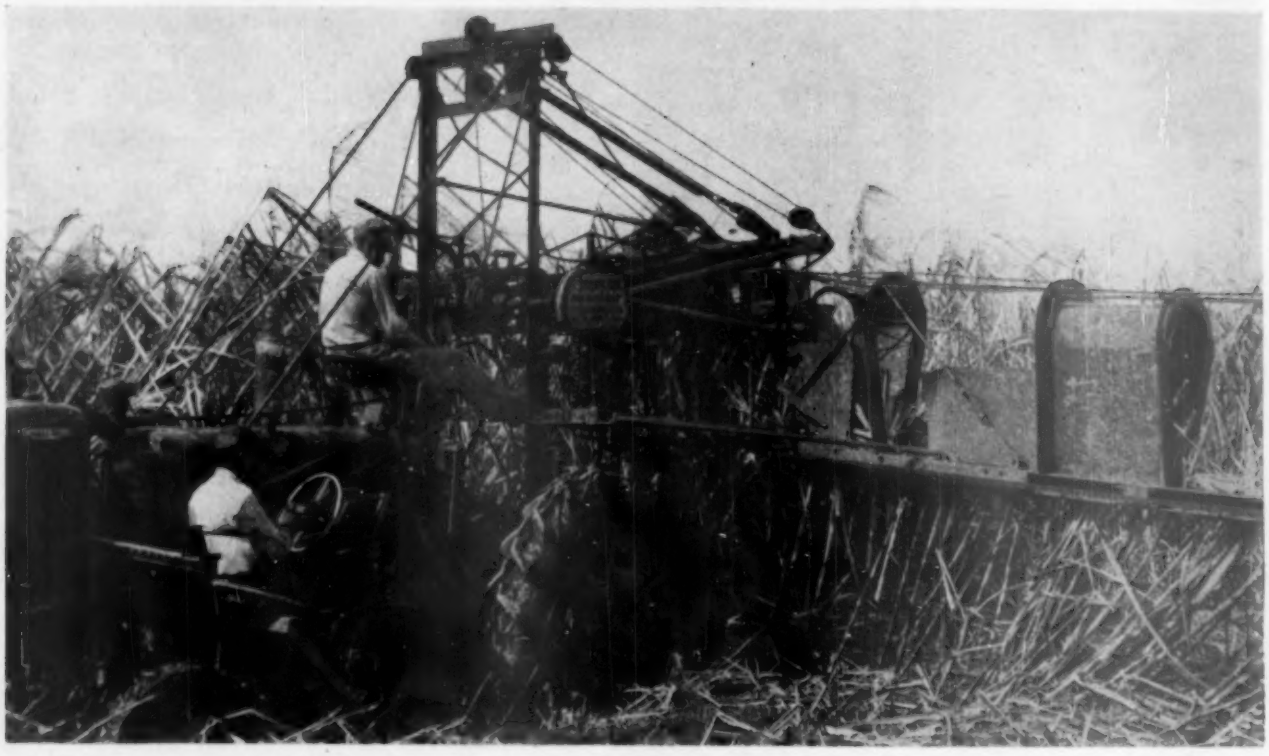


Fig. 1—A mechanical sugar cane harvester. With this machine, two men can cut eight to ten acres of cane daily

Hard-facing Brings Longer L

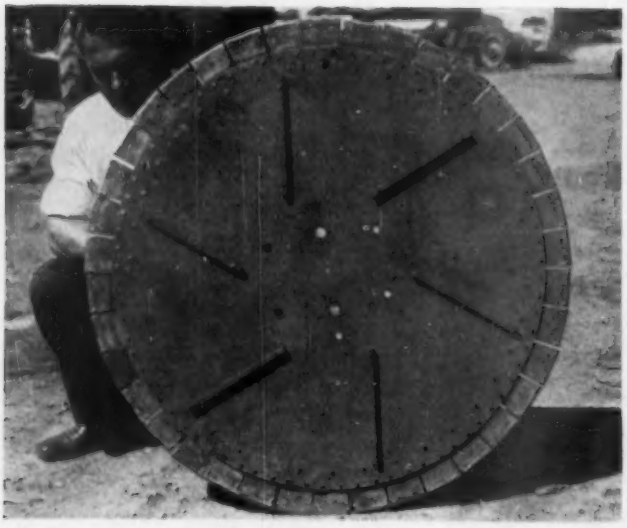


Fig. 3 — Whirling at 500 rpm, this blade would be dull and useless in less than two days without the protection of hard-facing. When the segments are properly hard-faced, however, the big disc will last out the 90-day harvesting season

Photos courtesy of Stoody Co.

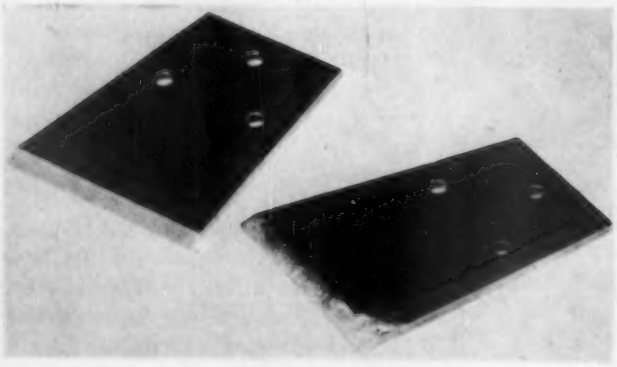


Fig. 4—Cutter segments. Segment at left has been ground sharp and is ready for hard-facing, already applied to the segment on the right. These segments are riveted to the circumference of the disc shown in Fig. 3

WHERE once a host of sweating negroes toiled with scythes to cut the sugar cane, harvesting today is largely accomplished by means of the mechanical sugar cane harvester (Fig. 1). This machine is first cousin to the combines operating in the wheat fields. Gathering chains guide the stalks to the cutter, after which other chains guide the cut stalks through the machine to be topped. Finally, the cane is laid out in neat rows, all ready to be loaded.

Two men operating this harvester can cut eight to ten acres per day. That means 200 to 250 tons of cane cut daily—an amount roughly equivalent to the work of 100 laborers cutting by hand.

PROTECTED BY HARD-FACING

Heart of this remarkable machine is a circular blade rotating about 500 rpm. Looking into the front end of a cane harvester (Fig. 2), we can see the means by which the stalks are guided to the whirling blade. The blade itself consists of 38 sharp-edged segments riveted to the outer edges of a medium-carbon steel disc

Fig. 2—Looking into the front end of a cane harvester. The circular cutting blade is indicated by the arrow

Life to Cane Cutters

(Fig. 3). Each of these cutter segments (Fig. 4) is fabricated from medium-carbon steel plate and ground to a keen cutting edge.

It is estimated that without hard-facing, a cutting blade would not last more than two days, whereas the application of a small amount of hard-facing material to protect and preserve the cutting edges enables the blade to outlast the full harvesting season of approximately 90 days.

The hard-facing is applied by the oxy-acetylene process and is a patented filler rod of mild steel and fused tungsten-carbide particles. In the manufacture of this rod, the particles are screened to size through a mesh and fed onto mild-steel strips by an automatic feeding device. The strips are rolled into cylinders with the tungsten carbide inside like shreds of tobacco within a cigarette paper. When torch heat is applied, the mild-steel sheath is melted. The particles of refractory tungsten carbide do not melt, however, but are flowed along the surface of the work with the molten steel. The screened particles of almost diamond hardness are uniformly distributed.

Each cutting segment is thus tipped with steel-embedded tungsten-carbide particles of a size to pass through a 30 by 40 mesh. The segment at the right of Fig. 4 has had the hard-facing applied to it and is now ready to be riveted back on the circular blade. After each season's use, the worn segments are exchanged for new hard-faced segments.

Knives Hard-Faced, Too

When the cane reaches the sugar factory, it is fed into a cutting mill, which cuts and shreds it into small pieces for the crushers and rolls extracting the juice. The cutting and shredding is accomplished by means of a series of knives, usually 27 in number, mounted on a shaft revolving at a speed of approximately 500 rpm.

One of these cane knives is pictured in Fig. 5. Its cutting edges have been protected with the same kind of hard-facing as that applied to the cutter segments. The set of knives thus hard-faced cut up 75,000 tons of cane—a whole season's run—whereas ordinary unprotected knives cannot handle more than 5,000 tons without resharpening.

Fig. 5—Hard-facing is also used on the cutting edges of the knives in the cutting mill. This knife cut 75,000 tons of cane without resharpening

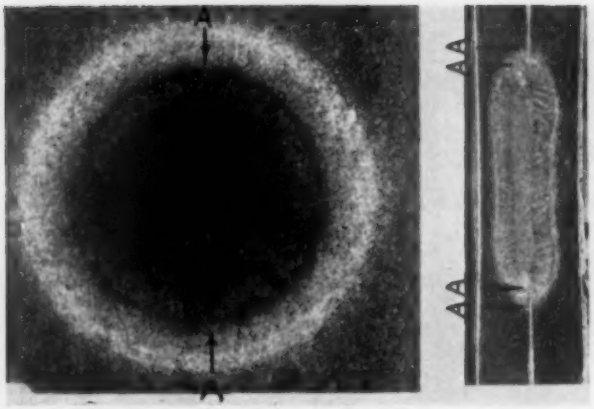


Fig. 1 (10 X)—Radiograph and section of a good spot weld in 0.040-in. 24S-T Alclad aluminum alloy. The dark ring A-A indicates boundary of weld nugget

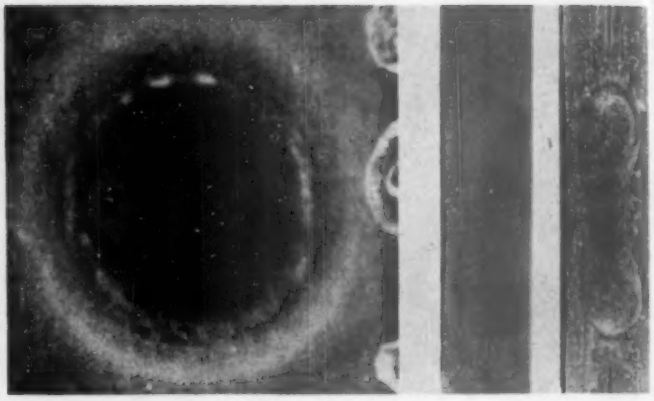


Fig. 2 (10 X)—Radiograph, section and section radiograph of spot weld in 0.040-in. JI-H magnesium alloy

X-Ray Inspection of Spot Welds

Non-destructive radiographic inspection of spot welds can be carried out at any point in the fabrication process and will give rapid and reliable indications of weld quality

BY ROBERT C. McMASTER
Assistant Research Supervisor, Battelle Memorial Institute

CERTAIN aluminum alloys are ideal from the standpoint of spot-weld radiography. Radiographs of spot welds in these alloys reveal clearly the weld structure, strength and quality. Not all aluminum alloys, and few if any ferrous alloys, provide equally informative radiographs. In nearly all sheet materials, however, radiography provides sufficient information to be of value in spot-weld process control.

X-Ray Sensitivity

The radiographic technique used for spot-weld inspection is by necessity extremely sensitive. The aluminum alloy 24S-T, for example, contains only about 4.2% of copper. Probably only a small portion of this is redistributed as a result of spot welding. To show these minor local changes in the percentage of copper by sharp radiographic images, in order to reveal the weld nugget, requires extreme radiographic sensitivity. In the radiographs shown with this article, a change of 0.1% (0.0008 in.) in the total thickness of the uniform sheet material would have been revealed. Even fine cracks and porosity in the weld nugget are revealed by dense black images. Very minor thickness changes, such as the minute displacement and thickening of the cladding in the corona region, can be seen clearly.

Radiographic images of spot welds are produced by irradiating the welded sheets with a practically uniform field of high-intensity, low-voltage X-rays from a source with low inherent filtration. Most of the X-rays are absorbed in the material being radiographed. The X-ray image of the spot weld is produced on the film because the sheets do not absorb X-rays uniformly throughout the entire area. Differential X-ray absorption between adjacent areas of the spot-welded sheet material occurs for three basic reasons: (1) Variations in the total thickness of the sheet material; (2) variations in material composition and structure, and (3) variations in the geometry of non-homogeneous layers such as cladding on sheet materials.

Defects Revealed

High-strength aluminum alloys, such as 24S-T and 75S-T, are very suitable for the radiographic inspection of spot welds. Each contains a relatively large percentage of a radiographically dense alloying constituent which makes it possible to obtain clear, high-contrast X-ray images. These images reveal the shape and area of cast alloy bonding at the faying plane, from which weld strength can be reliably estimated. They show positive indications of the following defects, which are directly related to weld strength, strength consistency and the quality of control:

1. Absence of the weld nugget.
2. Undersize weld nugget.
3. Excessive Alclad inclusion.
4. Doughnut- or crescent-shaped weld nugget.
5. Cracking in the weld nugget.
6. Porosity in the weld nugget.
7. Inclusions in the nugget or at the faying plane.
8. Segregation of eutectic in the parent material (often a sensitive indicator of welding heat).
9. Expulsion ("spit") at the interface.
10. Extrusion at the interface (usually the cause of excessive sheet separation).
11. Oversize weld nugget (excessive diameter or penetration).
12. Misshapen weld nugget.
13. Tip pick-up.

X-ray inspection is not so well suited to nearly pure aluminum alloys, such as 3S-0, which have only a small percentage of impurities and

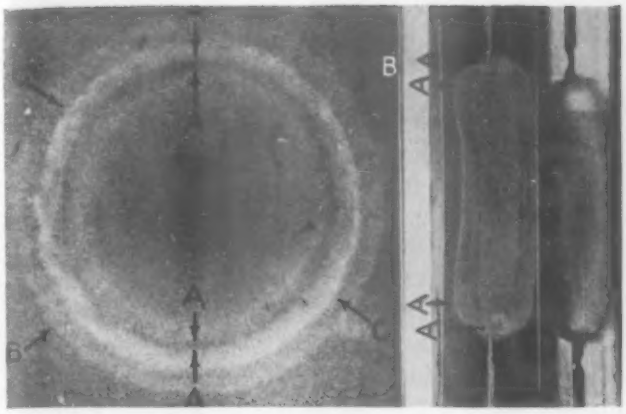


Fig. 4 (10 X)—Spot weld in 0.040-in. 24S-T sheet. Radiograph and section show the nugget boundary A-A, corona boundary B-B and segregation of eutectic (C-C)

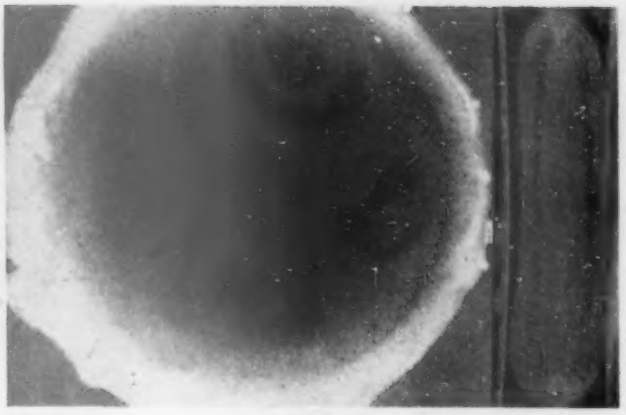


Fig. 7 (10 X)—Porosity and fine cracking are shown by the dark areas. Irregular white outer boundary indicates the extent of extrusion at the faying plane

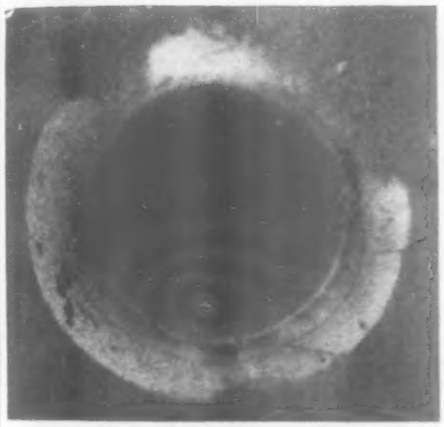


Fig. 3 (10 X)—Radiograph of a spot weld in terne plate (lead-coated steel)

other alloying constituents. Differential X-ray absorption as a result of composition or segregation is very difficult to observe in these materials. Similarly, in most ferrous sheet materials, the X-ray absorption properties of the common alloying constituents are not distinguishable, for small amounts of alloying material, from the X-ray absorption in the iron. Radiographs of spot welds in steel sheets seldom reveal the nugget boundary by a sharp image. However, weld defects which produce change in material thickness—*i. e.*, cracking and porosity or extrusion and expulsion at the faying plane—will be revealed by X-rays regardless of the nature of the sheet materials.

Nugget Boundaries

The boundary of the weld nugget in Alclad 24S-T and 75S-T aluminum alloys is revealed by the prominent dark ring A-A in Fig. 1. The outer edge of this dark ring shows the outer boundary between the nugget and the parent material. The inner edge shows the inner extremity of the Alclad inclusion into the weld nugget at the faying plane. These boundaries indicate respectively the nugget size and the net area of nugget bonding at the faying plane. The strength of the spot weld, insofar as it is due to the area of reliable bonding of cast nugget alloy at the faying plane, is indicated directly by the area enclosed within the dark ring. Similar dark rings are obtained in radiographs of spot welds in Alclad 24S-0 and bare 24S-T aluminum-alloy sheets.

In contrast to the preceding sheet materials, 61S-W aluminum alloy lacks radiographically dense alloying constituents in amounts sufficient to produce sharp, high-contrast radiographic images of spot-weld nuggets. The radiographs reveal only a dark central region which fades gradually into a lighter outer ring, with no sharp delineation of the nugget boundary. Only on large weld nuggets is the segregation sufficient to show any clear evidence of the nugget boundary or of local concentration of radiographically dense segregations in the parent material. The nugget boundary is equally difficult to observe in radiographs of spot welds in 61S-T, 52S-¼H, and 3S-O aluminum alloys and in most ferrous sheet materials.

Magnesium alloys such as 52S produce rather satisfactory images in which a prominent white ring occurs in much the same location with respect to the weld nugget as does the dark ring in radiographs of spot welds in 24S-T aluminum alloy. Fig. 2 shows that this white ring tends to be spotty and to disappear locally with some large nuggets. Its presence seems to be a reliable indication of the existence of a weld nugget, and when it is absent the weld nugget is also absent. The area within the white ring was found by test to correlate very well with the strength of the welds.

The lead coating over plain-car-

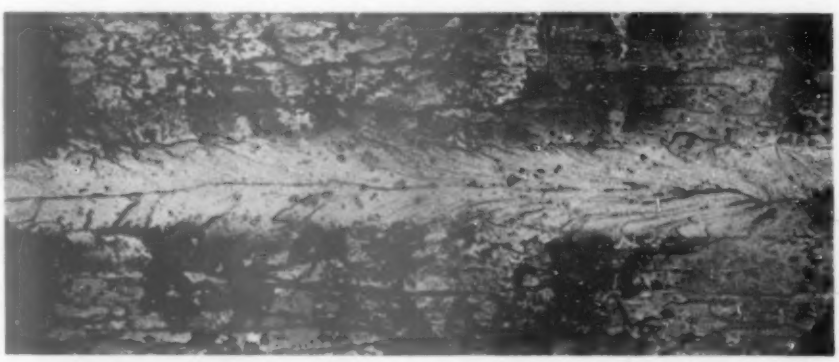


Fig. 5 (100 X)—Flow of Alclad material at the interface of a spot weld in 0.040-in. 24S-T. Nugget boundary at left, corona boundary at right

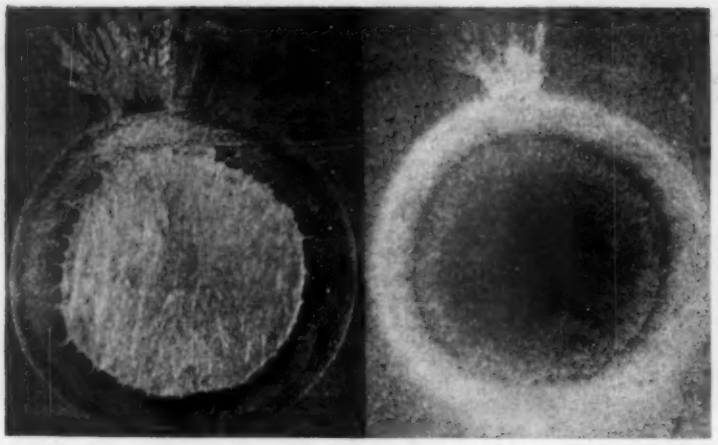


Fig. 8 (10 X)—Etched faying surface and the corresponding radiograph of spot weld with a small expulsion or "spit" indication

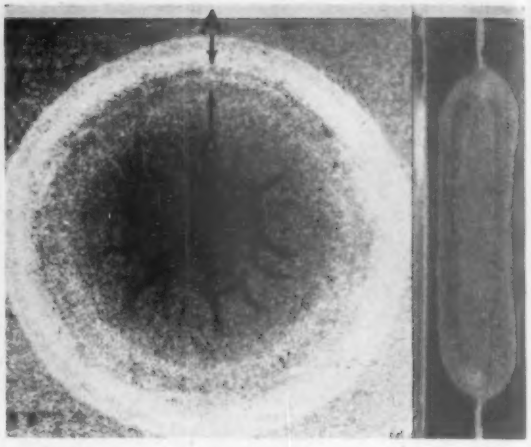


Fig. 6 (10 X)—Both nugget cracking and splitting of the dark ring A-A are shown here

bon steel in terne plate provides an interesting example of a cladding which is radiographically more dense than the core material. The radiograph of Fig. 3 reveals sharply the inner extremity of the cladding at the edge of the weld nugget as well as the outer boundary of the corona region in which the cladding is thickened.

The Corona Ring

The spot-weld radiographs provide information concerning the corona region at the interface. In Alclad aluminum alloys, the term "corona" is usually associated with those areas of the Alclad layers at the faying surface which have been influenced by welding heat and pressure. The light area between the dark ring A-A in Fig. 4 and the outer boundary B-B of the light band is produced by the effects of heat and pressure upon the Alclad material at the interface. The soft aluminum coating is pushed outward from the region of the nugget (as shown by the flow lines of Fig. 5) and increased in thickness in the corona region. The uniformly light ring on the radiograph indicates the area of the corona region at the interface but does not indicate whether the Alclad material in the corona region is strongly or poorly bonded. Similar corona rings are observed in radiographs of spot welds in many different sheet materials. They should not be confused, however, with evidences of segregation in the parent material, which will be described later.

Cracks and Porosity

Voids in the region of a spot weld result in black images on the X-ray film. Voids produce high-density images because X-rays pass through voids or gas pockets with far less absorption than occurs when they pass through equivalent thicknesses of metal. Hence voids usually appear intensely black on the X-ray film and can be readily distinguished from dark rings and other features resulting from local changes in the composition of the alloy.

For the same reason, cracks are revealed in the radiograph by prominent, sharp black images, frequently radiating spokewise from the center of the weld nugget (Fig. 6). Thin cracks in the granular zone of the weld nugget near the faying plane are revealed by fine, single-line images. Large cracks extending throughout a significant portion of the sheet thickness, or even to the sheet surface, usually show broad or multiple-line images. Such images are produced by the superposition of images of several layers of the crack, for deep cracks normally progress irregularly from the center of the weld outward toward the sheet surface. Welds containing cracks extending across most of the diameter of the weld nugget are easily differentiated from welds with only small cracks in the heart of the nugget.

Porosity in the weld nugget is revealed on the X-ray film by prominent, rounded black images, which may be located almost anywhere within the weld nugget. In two-layer combinations of sheets of equal thickness, the voids often lie in the faying plane. The size and number of the porosity indications, and their location with respect to the highly stressed regions of the weld nugget, determine their importance as structural defects. A typical example of porosity indications is shown in Fig. 7.

Faying Plane Defects

Alloy from the weld nugget is sometimes pushed out between the sheets at the faying plane (extrusion). This condition is revealed by a light radiographic image of the extruded alloy. Exact extent and outline of extruded material are shown by the irregular outer boundary of the light image (Fig. 7).

Expulsion ("spit") at the faying plane of the spot weld is likewise revealed on the radiograph by a light image of the expelled material (Fig. 8). This is because expulsion increases the thickness of the material through which the X-rays must pass and hence also increases absorption of X-rays, leaving the exposed film comparatively undarkened in the thickened areas. Expulsion indications are characterized by the typical shape of the "splashed out" material. It corresponds exactly with the shape of the expelled alloy at the faying plane (visible after the weld has failed in shear).

Segregation of Eutectic

The welding heat may cause extensive grain-boundary melting in the parent material outside the weld

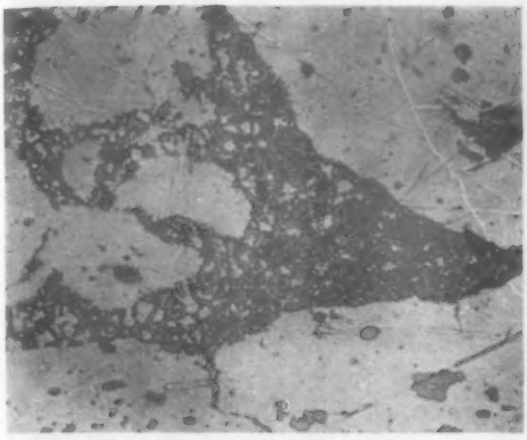
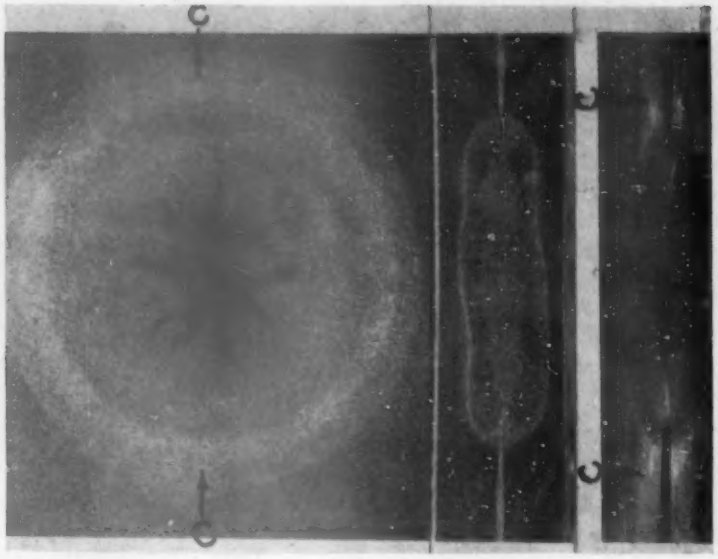


Fig. 9 (1,000 X)—Eutectic pool in the parent 24S-T aluminum alloy, outside the weld nugget



nugget, and in some cases the action of heat and pressure may cause segregation of pools of eutectic (the low-melting-temperature constituent of the alloy) just outside this region. These eutectic pools are radiographically dense and produce very light radiographic images. Fig. 9 shows a section of 24S-T parent alloy, including a typical eutectic pool.

A radiograph, section macrograph and section radiograph of a spot weld made with excessive welding heat are reproduced in Fig. 10. At this low magnification (10 X), the section macrograph does not reveal the eutectic segregation. The section radiograph (made by passing X-rays through a thin, vertical slice of the weld) reveals by white streaks (C-C) the location, extent and geometery of the segregation. The white image of the segregation is located outside the dark ring of the nugget boundary and may extend either inside or outside the boundary of the corona region. The presence, location and prominence of this white ring are sensitive indicators of welding heat and will indicate an increase of welding current above normal before any other evidence of this condition occurs.

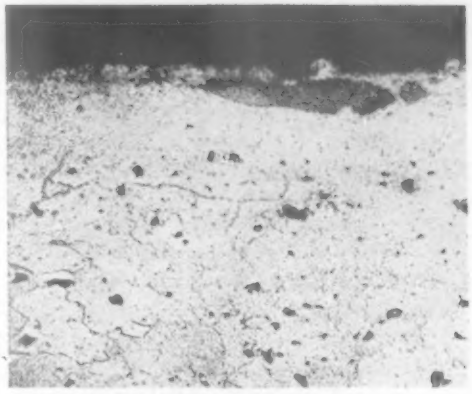


Fig. 10 (above)—Radiograph, section and section radiograph (10 X) of a spot weld showing segregation of eutectic in the parent material—best indicated by the white streaks at C-C in the section radiograph (right)

Fig. 12 (left)—Vertical section (1,500 X) through a spot weld with tip pick-up. The dark pool just below the outer surface results from alloying the aluminum of the sheet with copper

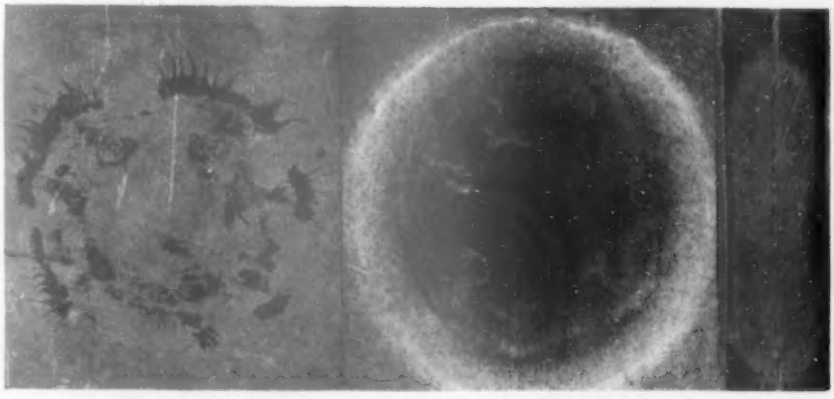
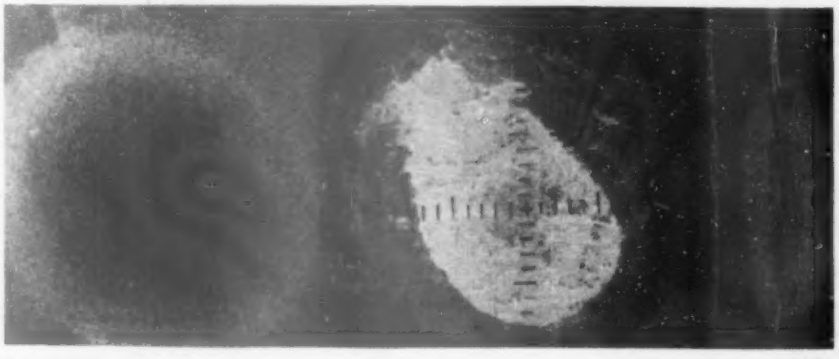


Fig. 11 (10 X)—Etched outer sheet surface, radiograph and section of a spot weld with tip pick-up (irregular white areas in the radiograph)

Fig. 13 (below)—Radiograph, faying surface and section (10 X) of a spot weld with partial expulsion at the interface indicated by a white image

Tip Defects

Tip pick-up may result in white radiographic images of irregular shape (Fig. 11). These light images are produced by the alloying of copper from the welding tips, which makes the aluminum-alloy sheet locally more opaque to X-rays. The alloying takes place near the sheet surface (since this is in contact with



the welding electrode tips), as shown by the cross-section macrograph of Fig. 12. If the areas of alloying are revealed by etching the outer surface of the welded sheet with Keller's etch (left of Fig. 11), they will be found to correspond exactly to the white images on the radiograph.

The tip may skid and push up a ridge of material on the outer surfaces of the welded sheets, the ridge being shaped in accordance with the contour of the skidding tip. The ridge tends to produce a thin white arc as its image on the radiograph. Such indications may be checked by visual examination of the surface of the welded sheet.

Tip skid may be associated with a condition of inadequate "holddown" pressure during welding, which induces partial expulsion at the interface. In this case, nugget-cast alloy material spreads out locally in a thin layer over the corona ring at the interface. The film of alloy expelled from the nugget increases the X-ray absorption and produces a light image of the area affected, as seen in Fig. 13.

Misshapen Welds

The radiographic dark ring A-A of Fig. 1 is highly important in the interpretation of weld shape from radiographs. Since this ring faithfully follows the outline of the bonded nugget area at the faying plane, misshapen welds are revealed clearly. In some cases, however, the weld nugget has somewhat different diameter or shape in the upper and lower welded sheets. This results in a splitting of the dark ring into two concentric rings or parts of rings (refer back to Fig. 6).

Occasionally, weld nuggets have a doughnut or crescent shape. Radiography reveals this condition clearly. Both the inner and outer extremities of the doughnut are shown by radiographic dark rings (Fig. 14). The net area of cast alloy (or nugget material) is the area between the dark rings enclosing the nugget region.

Control in Production

The preceding examples illustrate the scope and sensitivity of spot weld radiography, which has been found to be a suitable non-destructive test of spot welds in many sheet materials. The large number of significant weld properties and the sensitivity with which they are revealed and measured make radiography more useful for spot-weld inspection and quality control than any other non-destructive test method so far developed.

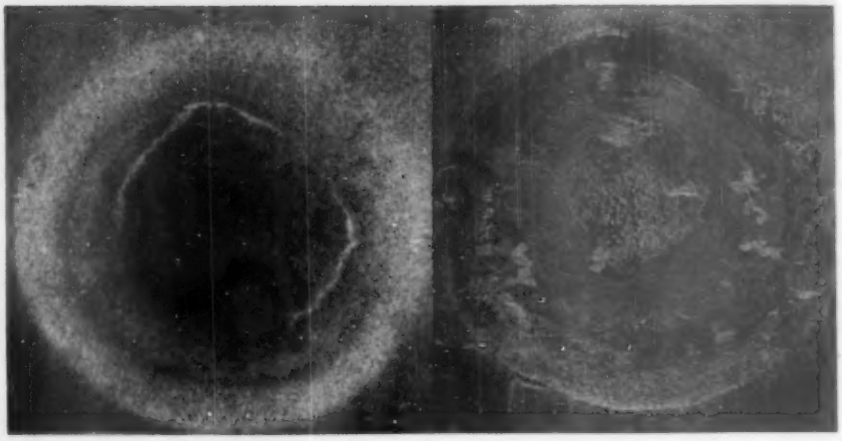


Fig. 14 (10 X)—Radiograph and faying surface of a doughnut-shaped weld nugget. Dark rings show the inner and outer boundaries of the nugget. White areas indicate segregation of copper-rich constituents of the nugget

Since radiographic inspection indicates the strength and quality of spot welds in the actual production structures, it provides a more reliable means of control than test coupons. Coupons, it should be noted, are not influenced by adjacent spot welds, poor fit and the surface conditions which affect weld quality and strength in the production parts.

With X-ray control of the spot-welding process, it is possible to adjust welding equipment to operate more nearly in the center of the optimum range for the specific material and gauge combination. With such adjustment, wider variation of welder performance can be tolerated without the production of defective welds. Furthermore, any tendency toward variation of operation of the welder can be detected and corrected by radiography before rejectable welds have been produced.

It is hoped that these examples may be of aid to process control and welding engineers in industrial plants where radiography of spot welds is now being introduced in accordance with the requirements of new specifications or of new applications of spot welding to primary aircraft structures.

Acknowledgments

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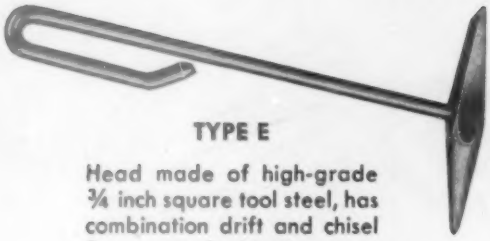
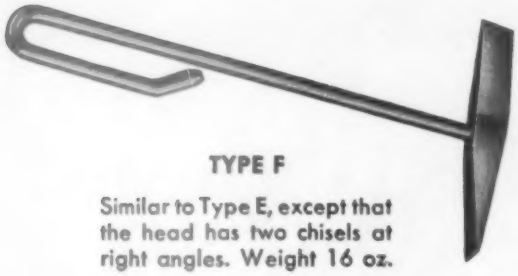


TYPE E

Head made of high-grade ¾ inch square tool steel, has combination drift and chisel for general chipping purposes. Special hand grip absorbs shock. Weight 16 oz.

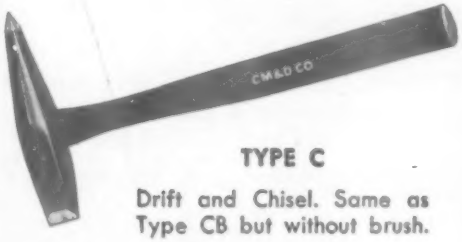
TYPE CB

Triple Duty. Combines 3 tools in 1—drift, chisel, and removable wire brush.



TYPE F

Similar to Type E, except that the head has two chisels at right angles. Weight 16 oz.

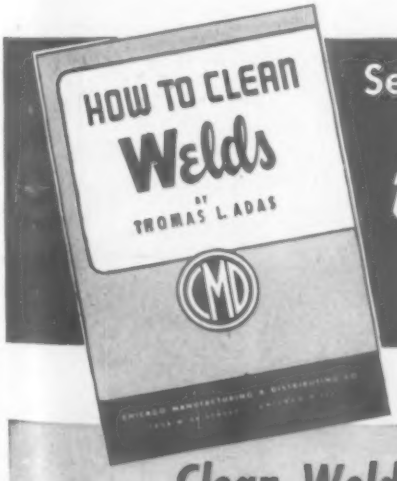


TYPE C

Drift and Chisel. Same as Type CB but without brush.

TYPES EB and FB

Models E and F can be supplied with brush as shown here. Brush can be replaced.



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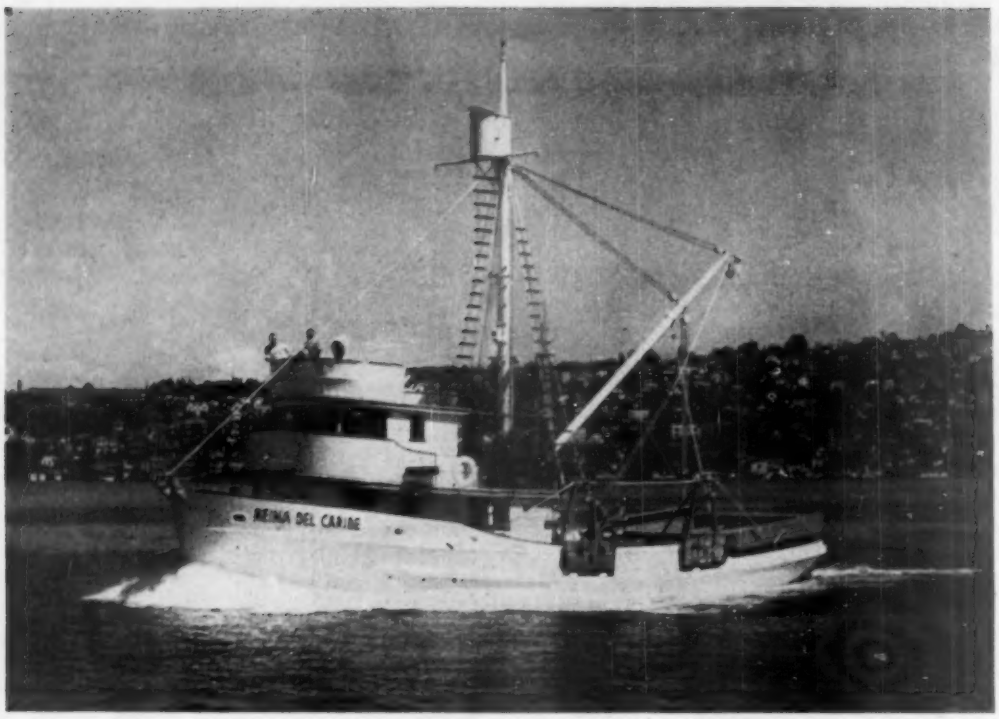

Fig. 1—*Reina del Caribe* on her maiden run. This all-welded steel fisher is 70 ft long and has a 20-ft beam

Prefabricated Ship Assembly

Useful lessons of the war were not forgotten by this Seattle shipbuilder. The problem was to build a 70-ft fishing vessel in three parts and join them together on the ways by welding

BOB LONG, Seattle's youngest shipbuilder and head of the Long Marine Construction Co., designed

BY MARGARET RALSTON
McGraw-Hill Pacific Coast News Bureau

the 70-ft *Reina del Caribe* (Fig. 1) and built her at approximately $145,000 for the Puerto Rico Agricultural Co. Basically, she was a West Coast fisher, but the owners requested changes in design which would adapt her for any type of exploratory fishing.

Remembering the lessons of the war, Long deemed it advisable to prefabricate the bow and stern sections separately under a covered portion of his yard where they would be protected from rain and weld them to the midbody after the latter had been built on the uncovered ways. The bow section measured 10 ft 6 in. and the stern 11 ft 6 in. The final hull assembly was done on the open ways (Fig. 2).

First, the ship was laid out in actual size on a loft floor, and the loftsmen made templates of paper and wood. The templates were laid on steel plates, which were punched and flame-cut to the punch marks. The plates were then formed, hot or cold.

Fig. 2—Finishing touches made from scaffolding on the open ways

Fig. 3—Looking from the stern deck at the aft section after it had been welded to the main body

PERHAPS YOUR REPAIR JOBS AREN'T THIS DRAMATIC BUT...

...Read how NI-ROD* came to the rescue of a badly broken block

It looked like "curtains" for this cylinder block of a much-needed tractor motor.

Many shops might have scrapped it rather than have attempted to make repairs.

But, this shop knew about Ni-Rod.

Carefully, they fitted the fractured parts. Then, with 1/8" Ni-Rod electrodes, they welded them securely into the cast iron wall.

Result: the motor block was restored to its original soundness, the motor reassembled, and the tractor put back in service.

Of course this is an extreme case. Most of your welding jobs may not be so big... or so dramatic. But, this gives you a pretty fair idea of what Ni-Rod can do.

It may suggest how this electrode can help you repair numerous other cast iron parts.

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Many automotive manufacturers today keep Ni-Rod handy to salvage damaged *new* iron castings.

For, Ni-Rod welds are high-strength, sound, machinable, and close-matching in color. You'll get smooth bead contours with Ni-Rod. Slag removal is easy. And, preheating is seldom necessary.

Take the word of scores of experienced welders: "You can't beat Ni-Rod for strong crack-free welds on cast iron."

Ni-Rod comes in 3/32", 1/8", 5/32" and 3/16" diameters. Try it yourself and see how easy it is to make on-the-spot, time- and money-saving repairs. Order a 5-lb. package from your nearest INCO distributor *today*.

*Reg. U. S. Pat. Off.

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THERMACOTE COMPANY

Newark Chicago Los Angeles Portland

Shell plates were ¼ in. thick; decks ¼ and $\frac{5}{16}$ in.; bulkheads ¼ in. The frames were formed of 3 by 2 in. angles, ¼ in. thick, with the 3-in. leg toeing to the shell. Quarter-inch longitudinal intercoastals were welded to the shell plates before the latter were welded to the frames.

Welding was done under the supervision of Charles Norton, using 300-amp d-c welders, for the most part with 5/32-in. mild-steel coated electrodes. Some $\frac{5}{16}$-in. and some ⅛-in. electrodes were also used.

While the bow and stern were being welded in a covered section of the yard, work was going ahead on the midbody on the open ways. When rain hampered work on the midbody, the weldors employed on it moved undercover and worked on the stern or bow.

The frames, welded to a 1 by 8 in. keel, stood 18 inches apart. The shaped plates were laid on them and, when necessary, trimmed to a perfect match by flame-cutting. They were then dogged up or held in position by the crane for welding. Root openings of from 1/16 to 3/32 in. were allowed for the welds. It is just here, in the welding of the plates to the frames, that Norton stresses the value of correct fitting and proper welding to obtain a smooth hull. Frame marks will show through and plates will buckle, he says, unless they are shaped perfectly and welded with sufficient root openings.

The prefabricated bow and stern assemblies were lifted by a 15-ton crane and held in position against the midbody for welding. Fig. 3 shows the aft section from the stern deck after it had been welded to the midbody. When the hull had been completed, the $\frac{5}{16}$-in. longitudinal girders for the engine room and the $\frac{5}{16}$-in. floor plates (¼ in. plates in the aft section) were welded in place. The fuel tank top was plug welded to the vertical supporting members running up to it from the keel. A $\frac{5}{16}$-in. support for the shaft alley above the ship's keel was also welded in place.

With four weldors and four shipfitters, the *Reina del Caribe* (Queen of the Caribbean) was built in four months. She is fully refrigerated for her capacity cargo of 75 tons of frozen fish and powered with a 250-hp Diesel giving her a speed of 10½ knots and a cruising radius of 6,000 miles.

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1. Welding sets *run idle* 50% to 95% of their total running time! Accurate tests on scores of installations prove this fact.

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3. There's an easy, practical way to cut idle running time to a minimum. Job-tested DV controls start the welder the moment the electrode contacts the work piece, and automatically shut down the welder 1 or 2 minutes after welding stops. The time delay (adjustable) keeps the set running while the operator changes electrodes, positions his work, etc.

The average number of starts with DV controls is but 15 per 8-hour shift, yet the savings in reduced idle time have—on hundreds of installations—paid the entire cost of DV controls in less than a year!

An accurate arc time totalizer (optional) records actual welding time in minutes. Production and cost data can easily be obtained without measuring weld footage or weighing rod.

DV controls are easily installed on any electric-driven d.c. welder. They do not interfere with the regular welder controls, nor with the operator's usual welding technique.

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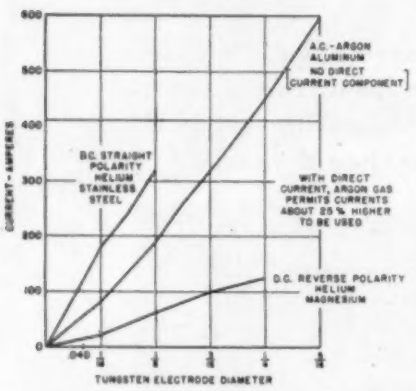
Short Cuts and Kinks

Inert-Arc Welding Current

SINCE there are many factors that affect the current-carrying capacity of the tungsten electrode used in inert-gas-shielded arc welding, and since there is no clear-cut maximum current that can be used with a particular diameter of electrode, there is apt to be confusion as to the proper current to use. The accompanying chart provides a convenient guidepost.



To find good operating current levels for tungsten electrodes, select the desired size and move upward to the curve representing the material that is to be welded

The chart shows current levels that have been used for manual welding in the General Electric welding laboratory for several years and gives current levels for each electrode size. These values are very flexible. For instance, a 1/16-in. tungsten electrode is shown to have its optimum current setting at 180 amp for straight-polarity d-c welding with helium gas on stainless steel. Actually, the 1/16-in. electrode will operate satisfactorily on current from 100 to 180 amp. Below 100 amp the arc may have a tendency to wander on the electrode tip and be a little wild, and above 180 amp the electrode may become molten enough to drop off. The over-180-amp current, however, may be operated very satisfactorily in certain applications.

In general, it is advisable to operate as nearly at the upper limit as is possible for each application since this usually produces the most stable arc.

* * *

Parts Angle-Joined

PROJECTION WELDING coupled with a simple holding fixture enabled Dedoes of Berkley, Mich., to join two formed parts at an acute angle to each other in the assembly of kitchen latches.

Dedoes had developed an original design for the flush latches on the doors and drawers of kitchen cabinets, but the attachment of the stamped trigger cam to the formed finger plate at an acute compound angle presented a grave difficulty to mass production. The two parts could be silver brazed in the required position, but this was rather slow and costly. It was believed that resistance welding could not be used unless costly and complex expanding or collapsing dies were developed.

The problem was turned over to the process engineering department of Progressive Welder Co., Detroit, who designed a simple fixture (left, bottom picture) that would enable both parts to be held in a standard projection welder. The upper die or electrode is recessed for the trigger cam, which is clamped automatically at the desired angle by means of a spring-loaded ball friction clamp. The lower die has a plain recess for locating the finger plate. The trigger cam was, of course, provided with two small projections.

This fixture permits straight-line retraction of the upper die after welding, avoiding the need for special collapsing dies. There is no marring of the finger plate, and the cost of joining is about ¼ that of silver brazing. Production is 600 units per hour.

* * *

Plastic Welding Fixtures

By Frank A. Peragine

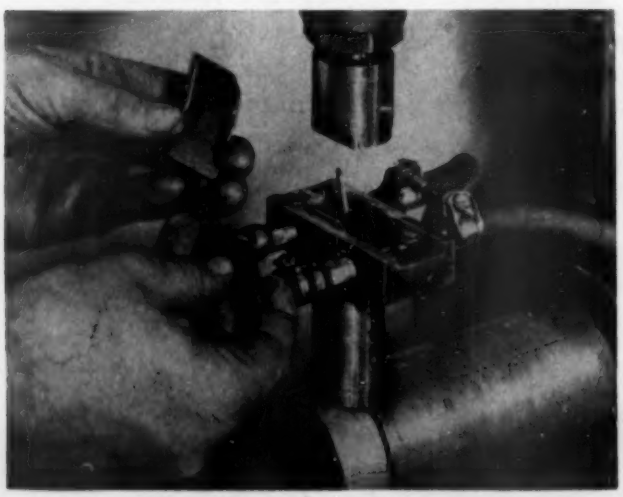
THERE is always a chance that spot-welding electrodes may come into contact with the template or fixture used to locate the work. If steel templates are used, such an accidental contact may cause arcing or even weld the template to the part. To eliminate all possibility of arcing, we are using templates made of plastic or Bakelite liner material. These non-metallic fixtures are lighter in weight and are made of transparent material that enables us to see readily what is being done during the welding operation.

* * *

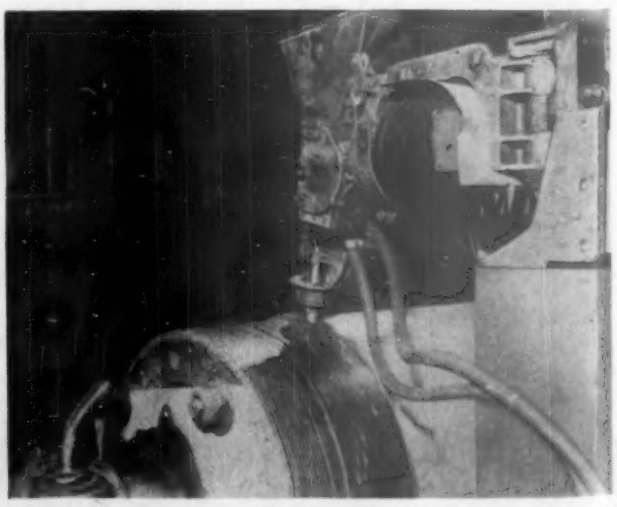
Build-up by Submerged-Melt

SUBMERGED-MELT automatic welding was recently called upon to build up the worn and pitted bearing area of a 24-in.-diam hydraulic press plunger. The method by which this was done was somewhat like the metallizing of cylindrical parts except that a welded instead of a mechanical bond resulted.

The automatic welding head was fixed to the carriage of a large lathe and slowly traveled the 9-ft length of the plunger as the latter was being rotated. When the rebuilding had been completed, the plunger was machined to its original size and returned to service at a fraction of the time and cost that would have been involved in obtaining of a new part.



This simple fixture holds the trigger cam and finger plate of a flush-type cabinet latch. The cam is spring-clamped in the upper die



Courtesy The Linde Air Products Co.

A hydraulic press plunger is rebuilt to size with automatic welding

What's the Percentage?

BY W. F. SCHAPHORST

THE job-shop operator often has difficulty in determining selling price because he does not know the relationship between cost and selling price. The answers to such problems may be easily determined from the accompanying nomograph.

To use the nomograph, first find your cost in column A and the percentage you want to add in column C. Run a straight line between these two scale points. The intersection of that line with column B then gives you the selling price.

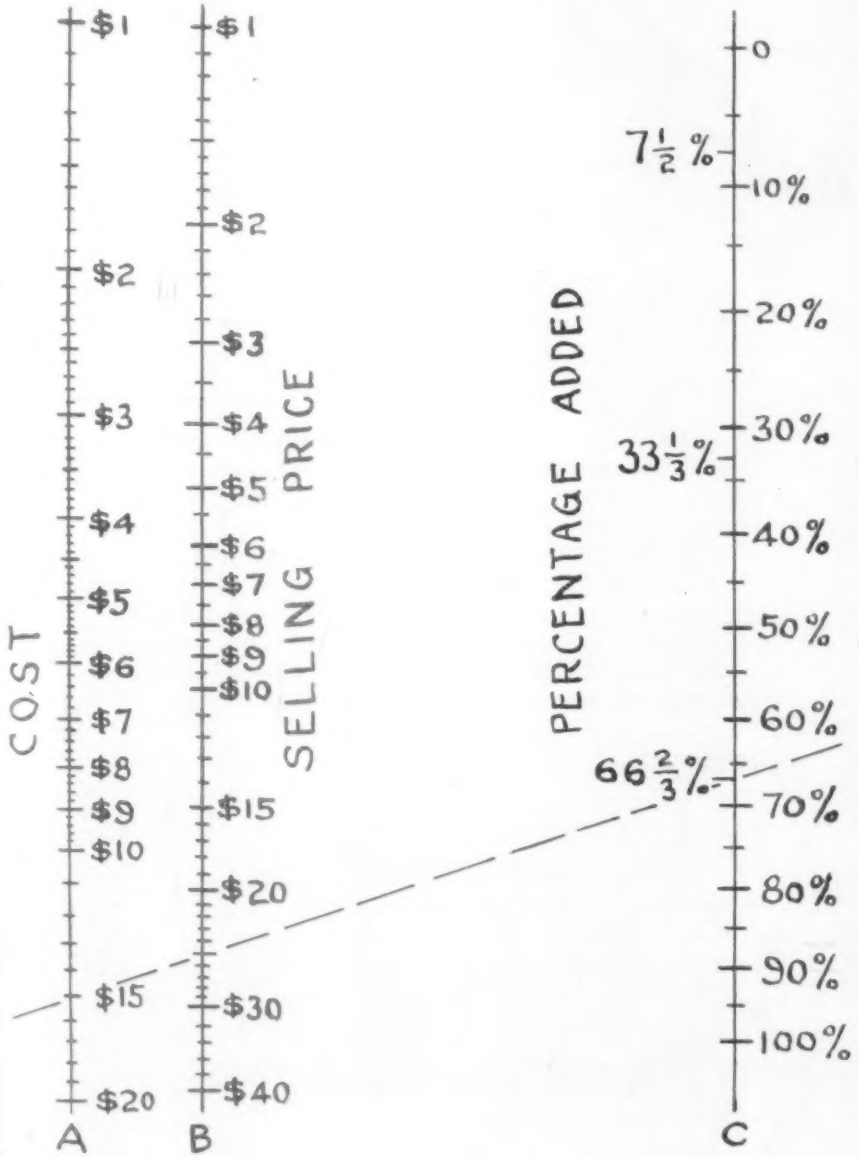
As an example, what will be the selling price if the cost of a job to you is $15 and you want to add 66⅔%?

Lay a straightedge (the dotted line) across the chart through the $15 in column A to the 66⅔% in column C. That line intersects column B at $25—the desired selling price.

Suppose you decide that you are going to sell the $15 job for $20 in order to meet competition and you want to know the percentage that will be added. You will find that a straight line through $15 in column A and $20 in column B gives the answer as 33⅓% in column C.

The chart will also take care of prices not shown. Column A varies only from $1 to $20, but it is a simple matter to add ciphers and thus extend the range to any amount. For instance, the cost is $150 and you wish to add 66⅔%; the selling price will be $250 (not $25) in column B. In other words, you simply add ciphers to both sets of figures in columns A and B. If you add one cipher to the figure in column A, you must also add one cipher to the figure in column B. And so on to as many additional ciphers as you wish. Column C will not be affected; if the cost is $1,500 and the selling price is $2,500, the same dotted line tells you that the percentage added is 66⅔%. The same is true if you subtract ciphers. Thus if the cost is $1.50 and selling price is $2.50, percentage added remains 66⅔%.

If you will do some experimenting with this chart and work out some problems that pertain specifically to your business, you will soon discover its convenience and value. Perhaps you will be able to make practical use of it for years to come.



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NEW PRINCIPLE—GREATER EFFICIENCY—Five separate hammer heads—each free to move 3/8"—are mounted on a single hammer handle. When a blow is struck, each of these free-floating heads strikes with equal impact at five different points, ***regardless of surface contour.***

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CONSTRUCTION FEATURES—Head segments of tool steel . . . Handle shank of 3/8" hard drawn mild steel . . . Both shank and head segments plated with cadmium to retard rusting—resists fusion of weld splatter . . . extra long, non-turning hickory handle assures perfect balance and insulation against shock. TWO MODELS—MP-1, as illustrated, and MP-2, similar in every detail except that one end of the head assembly consists of 25 pick points, five on each of the five floating segments, covering an area 5/8" x 5/8".

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POLITICAL ACTION—
Labor's Blind Alley

THE approach of the 1948 elections brings organized labor in America to a fork in the road.

Straight ahead lies the familiar route of free collective bargaining. Except for an occasional side trip, labor has been traveling it for years. On this road the role of government is to act as traffic cop, removing obstructions for all travelers.

The fork is the road of political action—the road to special privilege for labor. On it government is called upon to clear a special right of way for organized labor—to push aside all others.

Which of these two roads will organized labor take?

Most American labor leaders are now urging their followers toward political action. Their first objective is to "get" all members of Congress who voted for the Taft-Hartley Act. AFL plans to raise a $5 million political combat fund through contributions and a per capita tax on its membership. CIO is soliciting $1 donations for political action from its 6,000,000 members.

For their own sake, however, as well as for the welfare of the country as a whole, the rank and file of organized labor will do well to stop, look and listen before they turn their unions into political action squads. If they examine the facts for themselves, they will make two significant discoveries:

I. Political action is a blind alley for labor.
II. The Taft-Hartley Act is an essential bulwark of free collective bargaining.

A brief discussion of these two statements will show what they mean to organized labor.

I

Political action is a blind alley for labor.

If there is any doubt about that statement, a good way to dispel the doubt is to look at European countries where organized labor has been following a political action line.

Britain, where the Labor Party is in power, is such a country. How is labor faring there? Measured by the good things money buys, the average hourly wage in Britain is less than two-thirds of what it is in the United States. Part of the difference may be accounted for by the fact that the British Isles are poorer in natural resources than the United States. Another reason is the war damage to Britain's plants.

But there are two other big reasons why the British wage earner is far behind the American worker in enjoying the good things of life:

1. The *incentive to produce* has been dulled by vote-catching programs which promise economic security and a levelling of incomes. Lulled by promises of cradle-to-the-grave security and discouraged by high taxes, the British have descended to a state neatly described by the London *Economist:*

"Nobody gains anything from activity or suffers anything from inactivity."

2. To run a program like Britain's requires more and more government functionaries. Civilian employees of the British government have increased by 50% since before the war, putting one worker out of ten on the government payroll. More and more people stop producing and spend their time instead cutting up what others produce. The result is smaller production, higher taxes and lower real wages.

The British Labor Party must accept most of the responsibility for this sorry state of affairs. It is due primarily to a program of political action by organized labor which promised the individual worker security and equality of income—*but which can not deliver either because the incentive to work is gone.*

The lesson for American wage earners is clear. Political action by unions to enforce the economic fallacy of more-and-more-for-less-and-less will end by impoverishing the working man—and bringing the nation to ruin.

Unions exist for collective bargaining, not for politicking.

II

The Taft-Hartley Act is an essential bulwark of free collective bargaining.

Bargaining works satisfactorily only when both parties—management and labor—think they are getting a fairly even break.

Management was very sure that the Wagner Act, as administered from 1935 to 1947, was giving employers the short end of the stick. Furthermore, management's feeling of frustration was no whim. It was justified by case after case where rights were granted to organized labor with no counterbalancing recognition of the rights of management, of individual workers or of the public.

The Taft-Hartley Act goes a long way toward establishing equality in employer-union relations. It may fall short of doing a perfect job. *As a subsequent editorial in this series will show, it leaves virtually untouched the public menace of industry-wide bargaining and labor monopoly. And it leaves unprotected what should be the individual's right to hold a job without joining any particular organization.* But it *does* provide some major safeguards for collective bargaining by striking at abuses.

Organized labor, therefore, has no cause to damn the members of Congress who voted for the Taft-Hartley Act. True, the law will check what has been an uninterrupted march of the labor union bosses toward absolute power. It will do so just as laws in the past—The Sherman Anti-Trust Act, for example—have checked management when it was too greedy. And, as the first section of this editorial points out, the time has come to check the march of the big labor bosses.

Fundamentally, the Taft-Hartley Act gives free collective bargaining a new lease on life. The old lease was running out because the Wagner Act stacked the cards against employers, against individual workers, and against the public.

The road to free collective bargaining is now clear of many of the most menacing obstructions. It is the only road for labor to take in its own self interest. Union workers who let their leaders lure them down the blind alley of political action will do so at their own peril—and at the peril of this great industrial nation.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Company, Inc.

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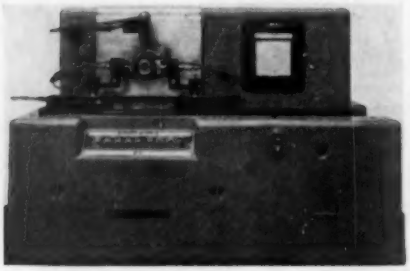


"Flamatic" flame-hardening machine for automatic production. Four heads may be used.

Flame-Hardening Machine

AN automatic flame-hardening machine, the "Flamatic," incorporates many new improvements in hardening techniques and holds parts within dimensional tolerances and to metallurgical specifications. The parts are rapidly heated to the desired surface temperature and then plunged in an oil quench. An electronic temperature control system holds the surface temperature to within ± 5F of the desired value in the critical transformation range at the instant the part enters the quench.

Operation is fully automatic except for loading. The operator simply places the workpiece on the holding fixture and presses the automatic cycle start button; this ignites the flames and starts the spindle to rotating. When the preset surface temperature has been reached, the flames are extinguished and the spindle stops rotating and retracts, stripping the work off the holding fixture and into the quench tank.

The rapid heating makes it possible to confine the heat to the surface of the part, permitting the core properties to be established by previous heat treatment. A uniform depth of heat penetration is also achieved and distortion is negligible.

Equipped with standard flame heads, this machine may be used to harden gears, shafts, barrel-type cams, pinions and other parts that lend themselves to rotation. Special flame heads and work-holding fixtures will accommodate it to a wider range of parts. CINCINNATI MILLING MACHINE Co., Cincinnati 9, O.

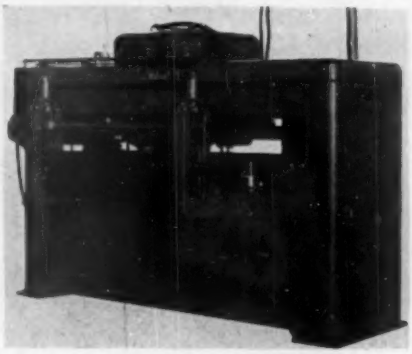
* * *

Carrying Case

TORCH, tips, regulators, hose, gloves, goggles, wrenches and miscellaneous equipment for gas welding and cutting can all be compactly arranged in an improved carrying case. The case is made of 22-gauge cold-rolled steel with flush double-lock seams, and it measures 22 in. long, 8 in. wide and 9 in. deep. Empty, it weighs 10½ lb. AIR REDUCTION SALES Co., Dept. 1558 P, 60 E. 42nd St., New York City.

Strip Seam Welder

A NEW double-roll series seam welder is designed for use as a traveling head in strip mills to join ends of strip or skelp into continuous lengths for long machine runs. The unit has a carriage moving on V-type wheels and is featured by a change-speed gear which gives a selective speed range of either 10 to 27 fpm or 20 to 54 fpm. It has a 125-kva air-cooled transformer wound for 220-volt, 60-cycle, single phase, a-c power supply. A center clamping bar between the two welding wheels locates the strip ends, permitting the weld to be made in one easy semiautomatic operation. FEDERAL MACHINE AND WELDER Co., Warren, O.



Double-roll traveling-head seam welder. It is available in four standard sizes

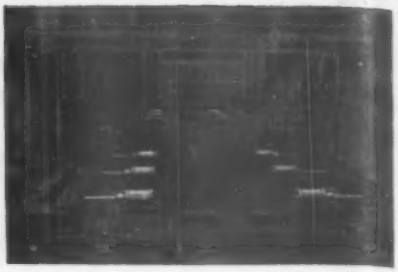
* * *

Photo Courtesy, The Lincoln Electric Co.

A lever ratio of 10 to 1 is developed when pressure is applied to "prybar" of this welded truck

Hand Truck

AN all-welded hand truck features a patented "prybar" which simplifies the lifting and moving of crates many times its own weight. A lever ratio of 10 to 1 is developed by this feature. The 60-lb. one-man-operated vehicle is constructed primarily of steel tubing, formed into shape and then welded together. Heavy-duty roller-bearing wheels of small diameter are used on the front end with castors at the rear. WHITING EQUIPMENT & MANUFACTURING Co., Charlotte, N. C.



Non-rotating air cylinders used with 100-kva spot welder for automobile sub-assembly

Air Cylinders

NON-ROTATING air-operated cylinders are being employed in collaboration with a 100-kva spot welder for automatic assembly, welding of rocker panels and side sills to the floor pans of automobiles. Twelve 3-in. cylinders are used to retract the lower mandrels to permit removal of part after assembly. The stroke is approximately 4-in.

This foot-mounted, double-acting type cylinder (Model "C") is equipped with one-piece piston, which permits replacement of packings with a minimum of effort. Such cylinders can be used wherever there is a need for controlled pull-push-lift or lowering action. ANKER-HOLTH MANUFACTURING Co., Port Huron, Mich.

* * *

Stainless Flux

COMPOUNDED for gas welding of stainless steels and high-chromium alloys, "Airco Formula No. 34" flux is said to dissolve the chromium oxides found in this type of welding. Applied by painting the immediate and surrounding surfaces, it protects the molten metal from oxidation. This flux replaces the company's "Kromeweld" flux. AIR REDUCTION SALES Co., 60 E. 42nd St., New York City 17.

* * *

A-c Welder

A NEW a-c arc welder that can be operated on 110-120 volts is announced for welding, brazing or soldering jobs in service stations, garages or sheet metal shops. Approximately 40 heat selections are available, and current adjustment may be made without interrupting the arc. This model, N110, handles up to ⅛-in. electrodes. GREYHOUND A-C ARC WELDER CORP., 604-606 Johnson Ave., Brooklyn 6.

* * *

Electrode for Poor Fit-Up

A HEAVY-COATED electrode "Hobart No. 12," is designed for a-c or d-c straight polarity at higher current ratings. The high current increases welding speed on poor fit-up jobs and reduces spatter loss. Another advantage is that there is less tendency to freeze the electrode to the work. The new electrode is available in 3/32, 1/8, 5/32, 3/16 and 1/4 in. diameters. HOBART BROS. Co., Hobart Square, Troy, O.

Electronic Rectifier

A NEW electronic rectifier, said to be especially useful for small d-c motors, magnetic chucks or similar applications requiring direct current, may be used to replace motor-generator sets where power from 750 to 2,000 watts is desired. Known as the series WR 40-50-60, this rectifier converts 115, 230 or 460 volts a-c into 115 or 230 volts d-c. A time-delay relay prevents operation of the power tubes until the filaments are properly heated; red light on the door shows when the unit is energized. WELTRONIC CO., DEPT. K, 19516 W. Eight Mile Road, Detroit 19.

Series WR 40-50-60 electronic rectifier for small d-c applications

* * *

Type W-50 safety goggle for welding

Safety Goggles

A NEW line of safety goggles is made in two types: one for welding, cutting, and brazing, the other for chipping and grinding. Welding goggles have 50-mm lenses, shades No. 3 through 6, and are protected by cover glasses. Eyecups are of moulded plastic, with ventilating screens and baffle plates on the outside to prevent fogging and protect eyes from flying particles and stray light rays. Type "W-50" has a plastic headrest and telescopic arms with concealed springs which do not interfere with prescription glasses. It may be raised and lowered with one hand in less than a second. Type "WR-50" has an elastic headband.

Grinding goggles are similar but have clear, hardened lenses and ventilating screens against flying particles. Baffle plates are not included. Type "G-50" has an elastic headband. JACKSON PRODUCTS Co., 31739 Mound Road, Warren, Mich.

to assure uniform performance of Titan Bronze Welding Rods

From the raw materials to the finished product, every step in the manufacture of TITAN Bronze Welding Rods is held under rigid metallurgical control. Each melt is subjected to chemical analysis and thorough physical testing. As a final precaution, actual welds are made to test the welding properties of the rods. Our metallurgical inspectors have complete authority, and no rods are shipped unless they have met our high standards of quality. TITAN Welding Rods *must be right.*

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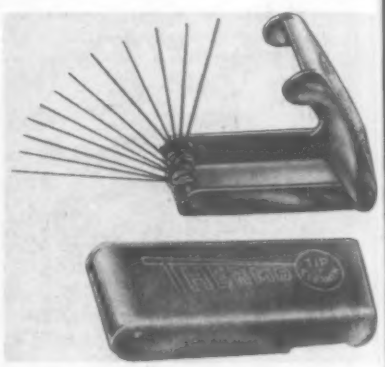
FOR BEST WELDING RESULTS USE VICTOR CABLE

Farm welders. Heat steps of model 130B range from 20 to 130 amp; 180B from 20 to 180

Farm Welders

CONFORMING with REA requirements and NEMA specifications, two new Trindl welders of the limited-input type are adaptable for farm or general maintenance or for use in auto repair shops or for light production welding. Both have 36 heat steps, ranging from 20 to 130 amp (Model 130B) and from 20 to 180 amp (Model 180B). Each model is furnished complete with headshield, electrode holder, welding, ground and power cables, wall receptacle and a supply of assorted electrodes. The welders are mounted on roller castings. TRINDL PRODUCTS, LTD., 17 E. 23rd St., Chicago 16.

* * *



Cleaners for welding torch tips. Recommended sizes are engraved on the back of each case

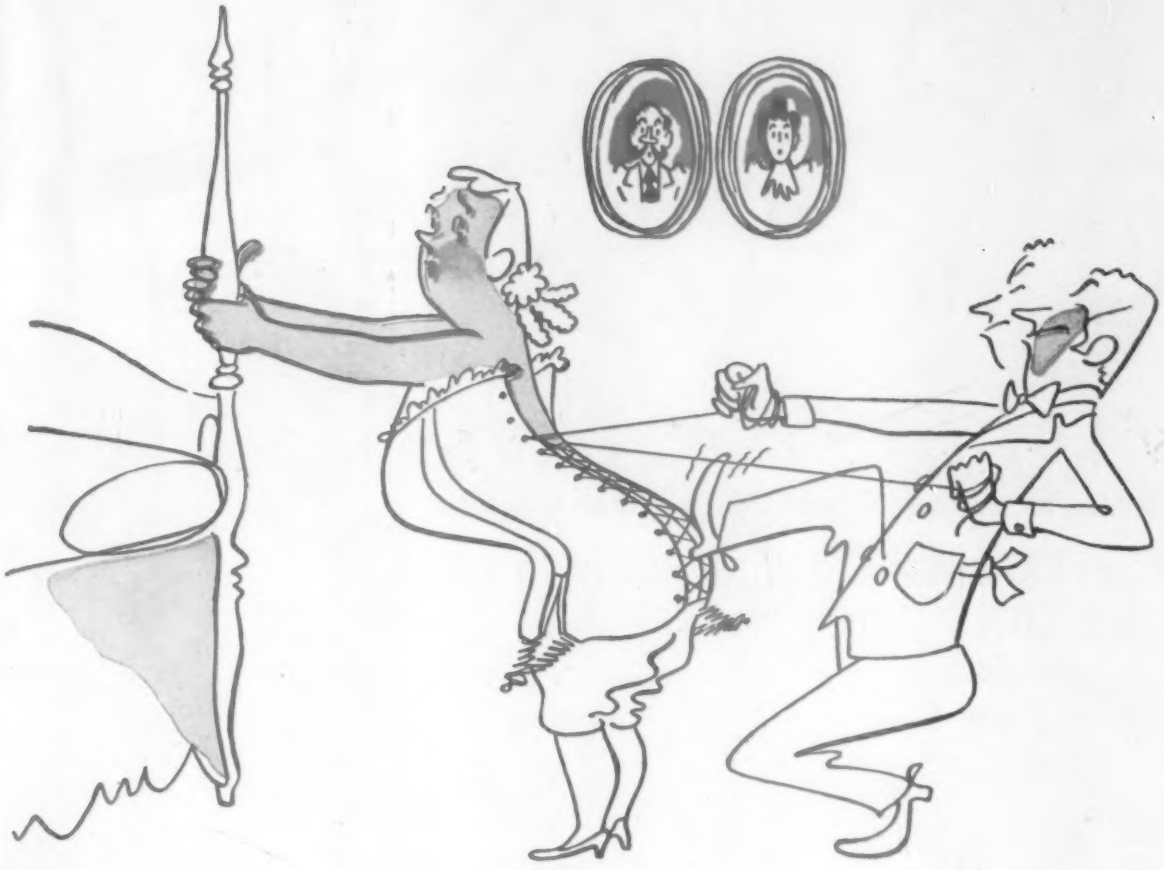
Tip Cleaners

DESIGNED for cleaning oxy-acetylene welding tips, two new sets of cleaners are offered in aluminum cases that prevent bending or other damage. The "Standard" set of twelve cleaners will clean drill sizes from Nos. 74 to 49, while the "Special" set cleans nineteen drill sizes from Nos. 47 to 30. A list of cleaner sizes to be used with the various drill numbers is engraved on the back of each case. THERMACOTE MFG. CO., 420 S. San Pedro St., Los Angeles 13.

* * *

Pressure Fans

DESIGNED for air conditioning, dust and fume removal, are two new types of Westinghouse fans known as "Axiflo." They are available as straight-through for convertible-elbow types, both furnished with either a three-bladed aluminum-alloy wheel or an eight-bladed steel wheel. Sizes vary from 18 to 72 in.; static pressures from 0 to 3 in. and displacements from 2,000 to 115,000 cfm. WESTINGHOUSE ELEC. CORP., Sturtevant Div., Hyde Park, Mass.



The Case of the Controlled Contours

Contour control is most important . . . especially to achieve good results in welding operations!

McKay Electrodes have the particular properties needed for proper regulation of bead contour, as well as weld metallurgy and arc action.

With McKay Electrodes, the operator lays down beads which are the exact size and shape required by the job. The weld metal is metallurgically sound, free from slag inclusion and has the correct mechanical properties.

Thus McKay Electrodes assist in producing stronger structures with less weld metal and lower finishing costs. *See for yourself. Test McKay Shielded-Arc Electrodes on your next job.*

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McKAY STAINLESS STEEL • MILD STEEL • ALLOY STEEL • WELDING ELECTRODES

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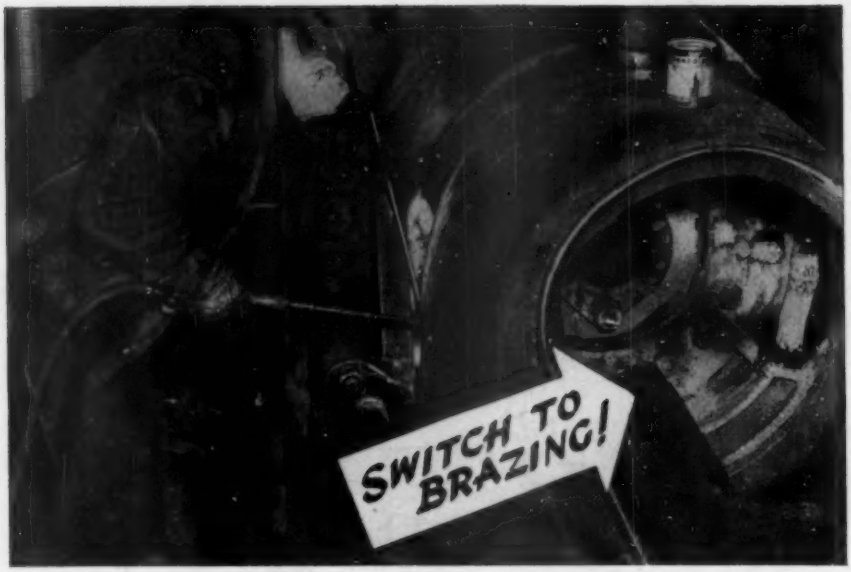

QUICK REPAIR WITH BRIDGEPORT No. 192 LOW FUMING BRONZE*

This six-ton crankcase casting for a 500 hp Heisler pump broke between crankshaft and piston. Replacement would have cost more than original price of the pump, because the part would have had to be made up specially. It was repaired in a comparatively short time by brazing with Bridgeport's No. 192 Low Fuming Bronze Rod.

This is typical of the savings in time and expense which can be effected by repairing broken or worn parts with Bridgeport Bronze Welding Rod. Often, equipment need not be dismantled to make repairs because extensive pre-heating and slow cooling are unnecessary.

Strong, dense welds are secured quickly with Bridgeport's free-flowing welding rods on steel or cast iron, for repairing breaks, building up worn surfaces or for fabrication. Investigate these advantages—write today for a copy of "Bronze Welding Alloys."

*Mfd. under U. S. Patents RE-17, 613 and 1,525,058

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BRIDGEPORT No. 192 BRONZE—LOW FUMING
General purpose alloy. Ideal for repairing heavy-duty equipment as well as small parts—building up wearing surfaces—joining parts in industrial and construction work.

BRIDGEPORT BRONZE
Fuses readily at 1625° F. Recommended for uniting cast iron and steel parts—building up wearing surfaces—joining parts in industrial and construction work.

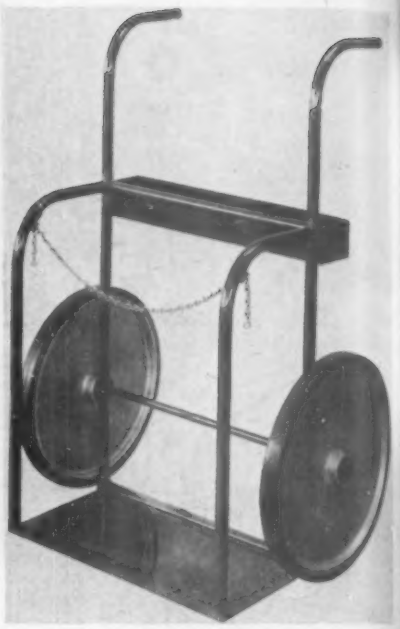
NAVAL BRASS
Not as high in tensile strength as Bridgeport Bronze. Suitable for repairing steel and cast iron—joining piping—building up wearing surfaces.

BRIDGEPORT MANGANESE BRONZE (NAVY)
Recommended for strength and toughness in repairing cast iron and steel castings—building up worn surfaces—joining parts in industrial and construction work.

BRIDGEPORT No. 1232 SILICON BRONZE
Used for oxyacetylene, carbon arc or metallic arc welding methods for making silicon bronze storage tanks, automatic heaters, corrosion-resisting ducts, structural sections, vats, etc.

BRAZING ROD
Satisfactory for conditions that are not subject to great wear or heavy shock loads.

Bronze Welding Rod A PRODUCT OF
BRIDGEPORT BRASS



Truck for large cylinders

Cylinder Truck

THIS model of cylinder truck is designed for large oxygen and acetylene cylinders. It is of sturdy, tubular construction and nicely balanced. A neat addition is a tool box for storage of tips, goggles, etc. Molded rubber tires and bronze bearings make its operation quiet and efficient. Specifications: height, 42 in.; width, 29 in.; weight, 65 lbs; capacity, large cylinders; wheel type, aluminum; bearings, bronze; tires, molded rubber; 18-in. wheels diameter. KNOLES FABRICATING CO., 1522 No. Indiana St., Los Angeles, Calif.

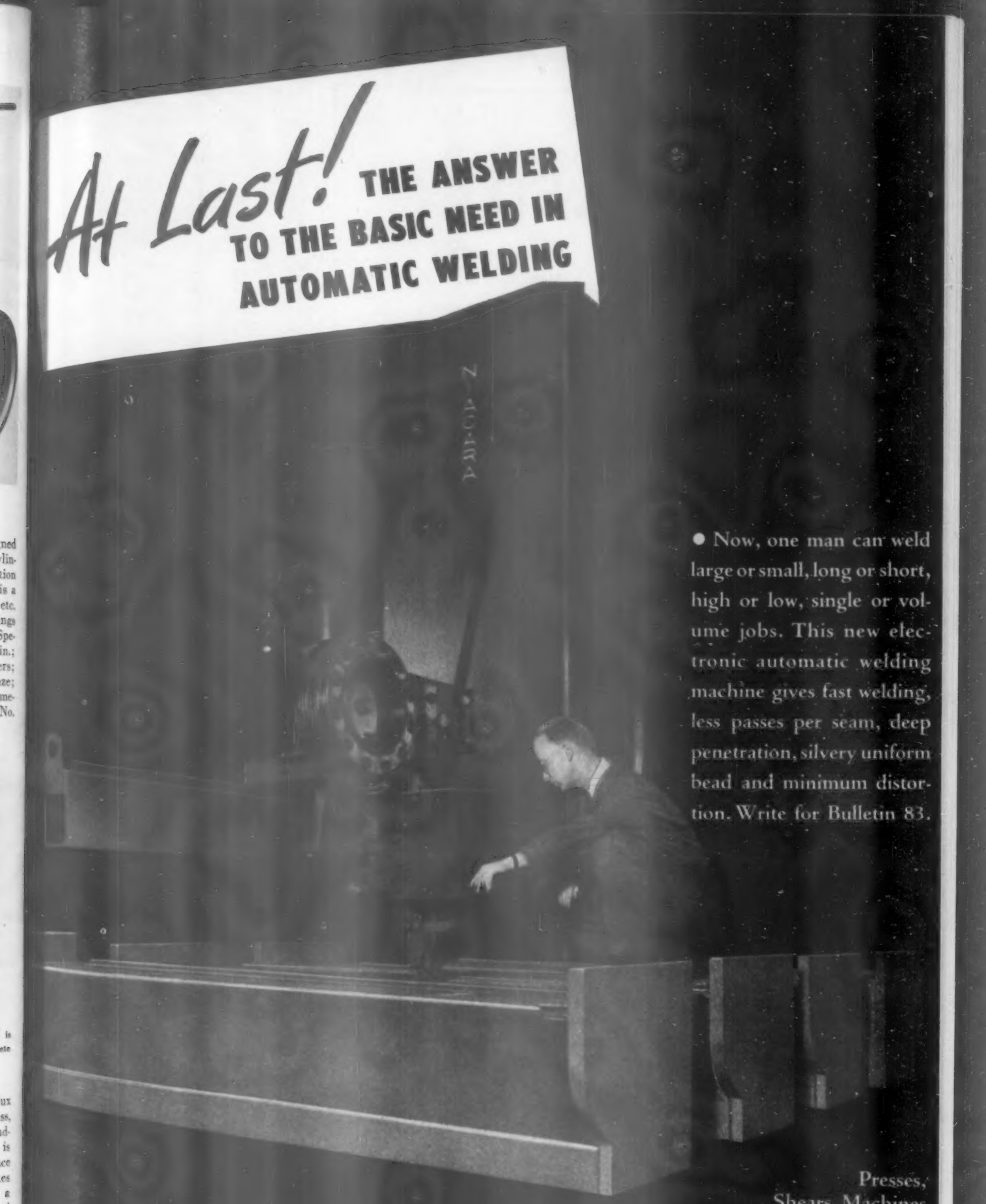
* * *

Fine as face powder, this new brazing flux is said to provide a dense coating and a complete envelope over the brazed surface

Brazing Flux

"THERMO-LO," a new anhydrous flux for brazing cast iron, copper, brass, bronze or steel is said to offer many advantages. It does not puff on a hot rod, is ground to the consistency of fine face powder, and its scavenging action makes for deep penetration. Using this flux, a large manufacturer of auto bodies and parts found that 450 operations to the pound could be achieved in brazing a reinforcing ferrule on an oil pan drain. FARRELLOY CO., 1243-45 No. 26th St., Philadelphia 21.

At Last! THE ANSWER TO THE BASIC NEED IN AUTOMATIC WELDING



• Now, one man can weld large or small, long or short, high or low, single or volume jobs. This new electronic automatic welding machine gives fast welding, less passes per seam, deep penetration, silvery uniform bead and minimum distortion. Write for Bulletin 83.

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"TIH-300-s" a-c welder for inert gas welding

Inert-Gas Welder

A NEW a-c welder designed for inert-gas welding embodies high-frequency stabilization to insure easy starting and dependable maintenance of the gas-shielded arc. A foot pedal instantly starts the arc through the tungsten electrode and simultaneously opens the valves permitting the gas and cooling water to flow through the arc torch. Releasing the pedal breaks the arc, but the gas and water will continue to flow for a predetermined length of time, adjustable up to 180 seconds. This delaying action protects the weld metal from oxidation until it has had time to solidify. HOBART BROS. Co., Hobart Square, Troy, O.

* * *

"Reflectogauge" measures thicknesses of tubing and flat metal parts up to 4 in.

Supersonic Gauge

"REFLECTOGAUGE" is a new instrument that utilizes supersonics for thickness measurement and flaw detection. It permits the thickness of metal objects to be measured when access is available from only one side. Maximum error in measurement is said to be less than 2% of the thickness of the material. Thicknesses of tubing and flat parts that range between 0.005 and 0.300 in. can be read directly from the face of the oscilloscope screen. The thicknesses of parts beyond this range can be computed up to 4 in. with slight calculation. This instrument is designed on principles similar to the Sperry "Supersonic Reflectoscope" and "Thruray." SPERRY PRODUCTS, INC., 15th St. and Willow Ave., Hoboken, N. J.

electrical engineering, the kinetic-energy type of stored-energy welder employs a simple a-c motor, a homopolar generator, a carbon-pile contactor and a flywheel. The single-pole generator produces continuous direct current at high amperage and relatively low voltage. Claim is made that it enables enough energy to be stored so that the peak power demand is only about five percent of the values required by an automatic single-phase resistance welder. The kinetic-energy-storage type welder may be used for spot, projection and flash welding. To date, developments have not been carried sufficiently far to make seam welding possible by kinetic-energy storage.

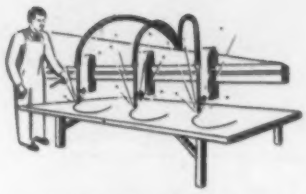
Spot welding has been making some notable advances in the structural steel field because of another new resistance process that is known as "three-phase" welding. Thicknesses of metal ranging up to 5/8 to 5/8 in. can be welded, and scaly steel can be handled without precleaning or pickling. There is much room for growth here.

Spot welding also continues to be popular in the airplane industry. New Boeing Stratofreighters and Stratocruisers, for instance, have a greater amount of spot welding than any airplane built by Boeing since 1936, the year the company first adopted the process. Spot welding is used both for structural and non-structural areas to obtain aerodynamic efficiency and structural integrity. Extensive tests show that two rows of spot welds possess the strength of three rows of rivets and that a single weld will exceed shear tests of more than 600 lb. Cost and timeliness are other advantages.

Material shortages held back welding in 1947. Industry, however, is looking forward hopefully to improved conditions in the coming year. It is our fervent hope that the Marshall Plan or whatever ramification of it we may adopt to aid Europe will not further disrupt industry and hold back industrial progress in the United States. As to what will be the outcome of our attempts in foreign aid, only time can tell. Should we be forced to revert to allocations, priorities and directives, a future that now looks bright may quickly become clouded.

FOR THESE JOBS . . .

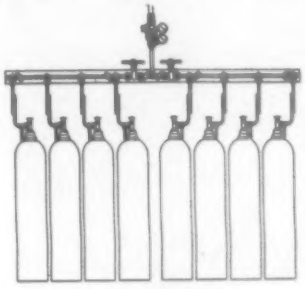
Production Welding



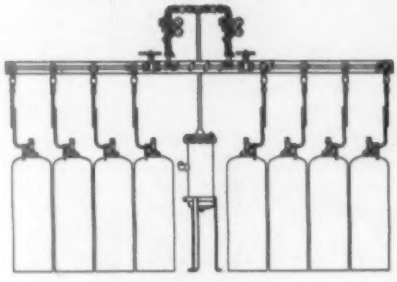
Production Cutting

. . . and operations such as welding and cutting heavy sections with hand torches, flame hardening and softening, flame cleaning . . . also any installation where a battery of cylinders is required.

YOU NEED THESE MANIFOLDS . . .



REGO
Oxygen Manifold



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Acetylene Manifold

BECAUSE OF THESE ADVANTAGES . . .

- *Added Convenience* . . . Individual shut-off valves at each cylinder station permit the removal of any cylinder without shutting down one side of the manifold. Master shut-off valves control flow of each bank of cylinders.
- *Unit Construction* . . . Header assembly, mounted to steel I-beam, is virtually one piece. Extra-heavy pipe is run through header fittings, cylinder station shut-off valves and master shut-off valves, with all permanent connections silver-brazed.
- *Precision Regulation* . . . Uniform delivery pressure is assured by large capacity two-stage Regolators.
- *Exacting Tests* . . . Every RegO Manifold is subjected to a sustained air pressure test before shipment.

REGO* Manifolds for Oxygen . . . Acetylene . . . Hydrogen . . . Nitrogen and other high pressure gases.

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News of the Industry

Canada Holds Its First Welding Show

More than three thousand persons came from many points of central and northern Alberta, Canada, to attend the first annual "Welding Day" of the Alberta Welding Association, held last November at the Prince of Wales Armories in Edmonton. Theme of the show "For the advancement of welding through education" was borne out by sixteen displays of welding equipment and accessories and by a complete program of demonstrations and lecturers.

Talks on welding standards were given by R. Gooderham of the Canadian Standards Association Welding Bureau and J. Spankie, chief welding examiner, mechanics branch, department of public works. C. W. Carry, president of C. W. Carry Construction Co., spoke on welding in the design and construction of buildings. Randall Walker, president of the Alberta Welding Association revealed the aims and objects of the Association.

Three educational films were shown through the courtesy of D. G. Latta, Ltd., and Chicago Vocational Training, Ltd.; on-the-spot demonstrations of new welding techniques were carried out in the display booths and at the main speaker's stand. Featured attractions of the exhibition included a "Crane-mobile"—a mobile crane of all-welded construction—and a display of modern military equipment.

* * *

Complete Burdett Oxygen California Plant

A monthly capacity of 2½ million cu ft of oxygen is the production goal of the newly completed Burdett Oxygen plant at Huntington Park, Calif. The plant is operated by the Burdett Oxygen Company of California, a subsidiary of the Burdett Oxygen Co., Cleveland, and was built at a cost of $350,000. The company's acetylene plant, capable of producing one million cu ft of acetylene per month, is located at Los Nietos, Calif.

The Burdett Oxygen California branch, under the direction of Jack Bernstein, will furnish industrial gases and welding, cutting and safety equipment to local industrial firms. A staff of approximately 60 employees will be used in the operation of the Huntington Park plant, when it reaches capacity production.

Though policies of the firm will conform to those established by the parent corporation, management and personnel will be entirely separate. William Young, formerly manager of the Cleveland acetylene plant, will be in charge of construction of the California acetylene plant. Winfield Rice, formerly of the oxygen industry in Portland, Ore., will be superintendent of the new oxygen plant.

Welding Speeds Erection of Houston Office Building

Through the use of on-the-ground fabrication of welded panels, rapid progress is being made in the construction of a three-story office building for the WKM Valve Co., Houston, Tex. The contractors, Brown Construction Co. and the Matthews Construction Co., are using I-beam studs and joists and welding them into 10-ft panels. Studs are one-piece members, of ⅛ in. minimum thickness, made from special rolled sections in 3, 4 and 6 in. widths with a 1¼-in. flange. It is claimed they will support a safe load of at least 6,000 lb when placed laterally.

The studs are welded in a jig on the ground, using E-6010 and E-6012 electrodes. When the panel is finished, it is lifted to a crew of four men on the structure, who then weld it into the framework.

* * *

Welded Wire Fabric Suggested for Concrete

A proposed simplified practice recommendation for the use of welded wire fabric as a reinforcement for concrete pipe has been submitted by the commodity standards division of the National Bureau of Standards to producers, distributors and users of this material for approval or comment.

The fabric, employed to reinforce concrete sewer and culvert pipes, is made by spacing longitudinal and transverse wires at regular intervals and welding them together where they cross. The proposed recommendation gives the area of longitudinal wire per linear foot of fabric and the spacing and gauge of longitudinal and transverse wires. It is estimated that the 45 styles recommended will satisfy 90% of the demand for welded wire fabric reinforcement.

Gas Ass'n to Meet In New York, Jan. 19-20

The Compressed Gas Manufacturers' Association, Inc., will hold its annual meeting at the Waldorf-Astoria Hotel, New York City, on January 19 and 20. Afternoon of the first day will be devoted to the annual business meeting, and the entire second day is scheduled for technical papers.

Among the several speakers will be Harry Boardman, Chicago Bridge and Iron Co., and Elmer Mattocks, Phillips Petroleum Co. Mr. Boardman will discuss the proposed revision of the ASME Unfired Pressure Vessel Code, and Mr. Mattocks will present data on the uses of ASME vessels in the gas industry. Other papers will cover the uses of inert gases in welding and the use of oxygen in the steel industry.

* * *

To Publish Journal on World Literature

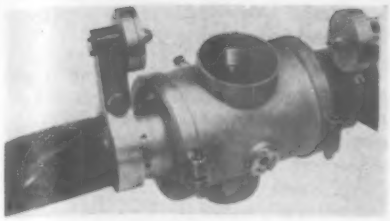
American Society of Mechanical Engineers, the Engineering Foundation, the Illinois Institute of Technology and other organizations are sponsoring a new monthly engineering and scientific journal, called "Applied Mechanical Reviews." Dr. L. H. Donnell, research professor of mechanics at the Illinois Institute of Technology, Chicago, has been appointed editor-in-chief. Dr. S. P. Timoshenko, of Palo Alto, Calif., professor emeritus of Stanford University, is editorial advisor. First edition of the magazine will appear some time this month and will be devoted to reviews of current world literature in the field of applied mechanics.

* * *

Weld Ladders for Water Tunnel Shaft

Patterson-Leitch, Cleveland, is building new wrought-iron ladders for Cleveland's Main Avenue water tunnel, located 85 ft below the surface. The ladders are to replace wrought iron rungs set in masonry which gave out after about 55 years. They are fabricated of 2½ in by ½ in. bars for sides and ⅞ in. by 15½ in. rounds, spaced 12 in. apart for the rungs. The rounds fitted into holes drilled in the bars and welded into place.

New oxygen plant of Burdett Oxygen Company of California, located in Huntington Park, Los Angeles. Production is expected to reach 2½ million cu ft per month



Internal welded structure of this propeller hub eliminated grinding

Three Men Win $13,000 Lincoln Foundation Award

First prize award of $13,000 in the $200,000 "Design for Progress" program of The James F. Lincoln Arc-Welding Foundation was divided among Paul Hackethal, chief engineer, Clarence C. Mast, shop superintendent and Douglas W. Hamilton, welding foreman, all of the aeromatic propeller department, Koppers Co., Baltimore, Md. Their co-authored paper described how welded design of a variable-pitch propeller hub (see accompanying picture) provided strength requirements to withstand repeated loads of thrust torque, centrifugal pull and gyroscopic action.

Kiser E. Dumbauld, design engineer of the bureau of bridges of the Ohio State highway department, received the second main award of $10,700 for his paper on the structural building and bridges classification. His subject was the redesign to welded structures of three of Ohio's bridges.

A paper on the redesign to welded construction of his company's "Trailbuilder" brought G. J. Storatz, engineer in charge of the road machinery division of the Heil Co., Milwaukee, the third main award of $8,200.

First prize of $3,200 in the maintenance classification was divided between W. W. Scherer, superintendent, and H. J. Ralston, maintenance metallurgist, Carnegie-Illinois Steel Corp., Munhall, Pa. Second prize of $2,200 was awarded to Joseph B. Smith, mechanical engineer, transportation department, Standard Oil Co., Cleveland. L. McWilliams, assistant powerhouse superintendent, the Shawinigan Water and Power Co., Shawinigan Fall, P. Q., Canada, won the third prize of $1,500 in this classification. Fourth prize of $1,050 was awarded to Carl N. Barlow, department of Water and Power, City of Los Angeles.

Awards in the research and education classification were given in the following order: $3,200 to be divided between Harry L. Anthony, III, senior fellow, and Harry P. Schane, technician, Mellon Institute of Industrial Research, Pittsburgh; $2,200 to George Welter, professor of applied mechanics, Ecole Polytechnique, Montreal, Canada; and $1,500 to P. F. George, metallurgist, magnesium laboratories, The Dow Chemical Co., Midland, Mich.

* * *

Airco Opens Two Retail Stores

Air Reduction Sales Co. has opened new retail stores for the sale of welding products at Erie, Pa., and Des Moines, Ia. The Erie store is located at 806 E. 12th St. and the Des Moines store at Tenth and Cherry Street.

For Better Wire Brushing ... at Lower Cost ... On All Welding Jobs!

WIRE CLEANING BRUSHES are made in several shapes for work in close quarters with electric Drills.

WIRE WHEEL BRUSHES come in six diameters from 4" to 12". Use on Bench and Portable Grinders.

WIRE CUP BRUSHES come in 4", 5" and 6" sizes. Use on Sanders.

Buy WHIRLWINDS*!

Here's a proven way to save plenty of time and hard work, while cutting wire brush costs, on all your welding jobs! Use Van Dorn Whirlwind Wire Brushes to prepare surfaces for welding by removing rust, scale and old paint. Use Whirlwinds after welding has been completed to remove light weld spatter, to clean and buff the surface for final finishing. Either way, longer-lasting Van Dorn Whirlwind Wire Brushes give you more for your money because . . . (1) an exclusive, patented lock *anchors* each tuft in place, separately, securely . . . (2) their *crimped* wire gives extra life and spring, maintains an even, compact brushing surface.

Van Dorn Whirlwinds are made in different models for use on Bench Grinders, Portable Grinders, Sanders and Drills. Order Whirlwinds today from your nearby Van Dorn Distributor. Write for free copy of our catalog to: The Van Dorn Electric Tool Co., 734 Joppa Road, Towson 4, Md.

*Trade Mark Reg. U. S. Pat. Off.

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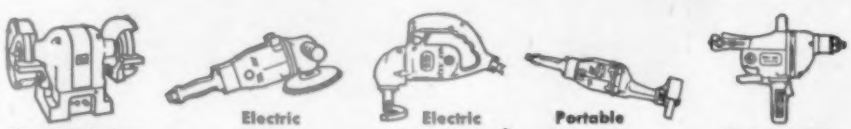
"Van Dorn"

(DIV. OF BLACK & DECKER MFG. CO.)

PORTABLE ELECTRIC TOOLS



Bench Grinders | Electric Sanders | Electric Porto-Shears* | Portable Grinders | Electric Drills

for dependable
PERFORMANCE

"FLUXINE" Fluxes are the result of over fifty years of scientific research into the metal-joining field. There are 89 FLUXINE Fluxes . . . one for every welding, silver soldering, brazing, and soft soldering operation . . . each with its own properties, designed for a particular metal-joining operation. All have been perfected not only for highest efficiency, speed, and long life, but for economy and safety as well. FLUXINE Fluxes produce no injurious fumes to irritate eyes or nose of the operator.

Write on your company letterhead for a generous sample stating which FLUXINE Flux you desire.

KREMBS & COMPANY
(Est. 1875)
Dept. G, 669 W. Ohio St., Chicago 10, Ill.

No. 4 FLUXINE, in powder form, for welding cast iron with bronze rods.

No. 7 FLUXINE for welding all types of aluminum.

No. 18C FLUXINE for gas and atomic hydrogen welding of stainless steels and inconel.

No. 41 FLUXINE used with high-melting silver solders on copper and its alloys and on steel.

No. 42 FLUXINE used with Westinghouse Phos-Copper rods and low-melting silver solders on copper and its alloys.

No. 43 FLUXINE . . . non-glaring . . . used when low-melting silver solders are specified. No injurious fumes. Goes further than most fluxes.

FLUXINE
TRADE MARK REGISTERED U. S. PAT. OFF.
FLUXES TO JOIN ALL METALS

LENAPE SPECIAL MANWAYS
SIMPLIFY DESIGN AND KEEP COSTS LOW

12"x18" Oval Manway and Swing Cover with Sight Opening.

When access openings of special type or special material are indicated, you may minimize both design time and construction cost by referring your requirements to Lenape.

We are regularly producing special constructions for chemical, refinery, food, cosmetic, beverage, pharmaceutical, and similar applications, in addition to our standard line.

Our recommendations as to type and material will simplify your design, procurement, and cost problems in the planning and initial estimate stages.

Quotations will be given our immediate attention—Bulletin 4-61 and current price schedule M-47 will be sent upon request.

LENAPE HYDRAULIC PRESSING AND FORGING CO.

LENAPE HYDRAULIC PRESSING & FORGING CO.
Dept. 104 West Chester, Pa.
BIG MAN PRODUCTS

To Stage Pan-American Engineering Congress

UNITED STATES engineers will join engineers of South America in a Pan-American Engineering Congress, to be held in South America late in 1948 or in 1949. The congress will be sponsored by the Engineers Joint Council committee on international relations. Canadian engineers also will be invited, through the Engineering Institute of Canada. J. S. Thompson of the McGRAW-HILL BOOK CO., New York City, has been representing the Council at planning meetings held in Lima, Peru, and Mexico City.

Bogota, Colombia, has been suggested as the place for the first congress. Participation will be recommended to all constituent societies of the Engineers Joint Council.

* * *

Cornell Receives Endowment for Metallurgical School

CORNELL University has established an endowed professorship of metallurgical engineering named for Francis Norwood Bard, owner of the Barco Mfg. Co., Chicago, who presented a $250,000 fund to endow the professorship. The university has redesignated the school of chemical engineering as the school of chemical and metallurgical engineering in order to place new emphasis on the instruction and research in metallurgy.

* * *

Trend Continues Toward Welded Freight Cars

ATTITUDE of American railroads toward welded construction in the manufacture of freight cars is reflected in the recent award of 3,160 freight cars to the American Car and Foundry Co. by the Atlantic Coast Line Railroad. The award includes eighteen hundred freight cars, one thousand hopper cars, two hundred 50-ton pulpwood cars, one hundred 70-ton phosphate cars and 60 covered hopper cars.

* * *

Production Show in Chicago, Mar. 22-24

CHICAGO'S annual Production Show will be held March 22-24 at the Stevens Hotel, concurrently with the Chicago Technical Conference. Information as to exhibit space may be obtained from Paul A. Jenkins, executive secretary, Chicago Technical Societies Council, 53 W. Jackson Blvd., Chicago 4. An attendance of around 25,000 is expected.

* * *

New Flux Maker on Pacific Coast

FRANK PACE, JR., formerly a chemist with Solar Aircraft Corp., has formed his own company, Sierra Welding Flux Co., San Diego, Calif., for the manufacture of welding flux for nickel, cobalt and certain stainless steels. Site for a permanent plant is being sought in the Pasadena area.

Add Welding Course at Stevens Night School

INDUSTRIES training school of Stevens Institute of Technology, which offers high school graduates evening courses in engineering and production, has expanded its curriculum to include advanced courses in welding and the mechanical fabrication of metals.

Three new instructors from private industry have been added to the staff. Boniface E. Rossi, research metallurgist, Baldwin, N. Y., will teach the new welding course; William D. Renner, safety engineer at Westinghouse Electric Corp., will teach industrial safety; and Henry J. Rolfs, head of the department of industrial relations, development and research at Westinghouse, will teach industrial psychology.

* * *

All-Welded Ships Built for Argentine

INGALLS SHIPBUILDING CORP., Pascagoula, Miss., is building four all-welded steel ships at a cost of $2,700,000 each, for the Argentine Institute of Trade Promotion. Each vessel will be 232 ft long, 42 ft, 6 in. in beam and 15 ft, 6 in. in depth, displacing 1,700 tons. Power will be afforded by twin-screw direct connected Diesel engines, totaling 700 hp for a speed of 9.5 knots, loaded.

* * *

Sperry to Move to Danbury, Conn.

CONSTRUCTION of a monitor-type manufacturing building and a three-story office building have begun at Danbury, Conn., for the manufacturing plant and general offices of Sperry Products, Inc. The company expects to move from Hoboken, N. J., to Danbury some time next summer. It manufactures detector cars for testing railroad rails in service and several nondestructive testing instruments employing ultrasonic principles.

* * *

"I got the bumpers unhooked, Buddy!"

For Emergency Repairs

...weld cast iron with Ampco-Trode 10 —save time and money...

Typical of the way Ampco-Trode 10 saves money for its users is this tricky repair job. This cast-iron road-grader drive housing was badly damaged when a drive shaft broke. Replacements were not available. Ampco-Trode 10 took over. Only a slight preheat was necessary so that the welder had no trouble in handling the casting. All joints were V'd out and the welding done in two passes — once with an 1/8" rod and again with 3/16" rod.

One of the breaks passed through a machined flange. But the fact that Ampco-Trode 10 provided a machineable deposit as well as good strength and ductility solved this problem.

You, too, can save time and money with Ampco-Trode 10. This all-purpose aluminum bronze electrode gives you these important welding advantages:

- **Welds dissimilar metals**—steel to clean cast iron; steel or cast iron to bronze, brass, and copper; and all these to nickel alloys.
- **Ideal for bearing applications and overlays** — where hardness and resistance to wear are essential factors.
- **Resists corrosion** — this quality is extremely useful when fabricating process-industry equipment.

Get a supply of these easy-to-use, money-saving aluminum bronze electrodes today. See your nearest Ampco distributor. Write us for latest Ampco-Trode 10 bulletin giving additional facts.

AMPCO TRADE MARK

Ampco-Trode 10 is a product of

Ampco Metal, Inc.

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W-101

Photologue--------FOR WELDING CATALOG SERVICE

Many welding equipment distributors realize the importance of placing their own catalogs in the hands of their regular and potential customers.

Photologue compiles the copy,—also gets an okay on the proof from the manufacturers of the products shown,—prints the catalog by the new photo off-set process. The catalogs are bound to suit the distributor's taste.

Write for samples and additional information.

Photologue Publishing Co.
CATALOG PUBLISHERS
610 W. VAN BUREN ST. - - - - - - - - CHICAGO, ILLINOIS

AC SEACO DC TRADE MARK the overlay for

LIPS THAT DO A BETTER JOB!

Lips, buckets, hammers, shovel teeth—ALL your equipment gets a new lease on life with SEACO HARD FACING WELDING ELECTRODES. High resistance to abrasive wear and actually improves with use. Takes terrific impact. Wears as long as many of the more expensive hard surfacing electrodes. Deposit in 1 or 2 layers. CANNOT BECOME SOFT EVEN OVER HADFIELD MANGANESE STEEL OR MANGANESE NICKEL STEEL because parent metal cannot absorb SEACO alloys. Ideal overlay for Manganal.

NAME OF NEAREST DISTRIBUTOR UPON REQUEST

FREE FOR THE ASKING! Our Booklet, "The Welding of 11% to 14% Manganese Steel."

STULZ-SICKLES CO.
Sole Producers
91 N. J. Railroad Avenue, NEWARK 5, N. J.

NEMA Elects New Section Officers

THE National Electrical Manufacturers Association recently elected new officers for its arc welding section. They are: W. W. Reddie, assistant to manager, welding department, motor division, Westinghouse Electric Corp., Buffalo, N. Y., Chairman; S. B. Owings, engineer, equipment sales, A. O. Smith Corp., Milwaukee, Chairman of the technical committee. Mr. Owings was also elected Chairman of the machine group, arc welding section.

* * *

By-Products Steel, Lukenweld End Corporate Existence

IN ORDER to streamline the business and simplify its tax and accounting structures, two wholly owned subsidiaries of Lukens Steel Co., By-Products Steel Corp. and Lukenweld, Inc., have ceased their corporate existence. No change in management or personnel is involved. Proper titles for each are: Lukens Steel Company and Divisions, By-Products Steel Co., division of Lukens Steel Co., and Lukenweld, division of Lukens Steel Co.

* * *

Finns Ask for Technical Books

IN AN attempt to reëstablish the war-torn Teknillinem Korkeakoulu (Institute of Technology), Helsinki, Finland, Dr. Martti Levon, director, has expressed a desire to receive gifts of scientific and technical books and periodicals from America. Gifts should be sent to the Legation of Finland, 2144 Wyoming Ave., N. W., Washington, D. C., marked for the Institute of Technology.

* * *

G-E Forms Welding Equipment Division

WELDING activities of the General Electric Co., will be consolidated in the newly formed welding equipment division, which will operate in coördinotion with the company's apparatus department. Management of the division will be under the direction of a welding equipment committee headed by A. F. Vinson, assistant production manager of the apparatus department.

* * *

Belmont D. Smith, vice-president, Industrial Overlay Metals, Inc., pilots own plane to keep in contact with salesmen

Corrosion Engineers to Meet at St. Louis

FOURTH annual conference and exhibition of the National Association of Corrosion Engineers will be held at the Jefferson Hotel, St. Louis, April 5 to 8. The exhibition will display the latest equipment, material and methods for combating corrosion.

* * *

New Life for Railroad Rails

LOWER maintenance costs and longer life for railroad rails subjected to the corrosive action of the track pan may be effected by welding the rails into long lengths. Oxweld Railroad Service Co., Chicago, has made 219 oxy-acetylene pressure welds at the track pans along one of the country's large railroad systems, and the results are said to be highly satisfactory.

* * *

Acknowledgment

WE WISH to express our regrets to the International Nickel Co., Inc., that acknowledgment was not given for their courtesy in supplying us with the photographs reproduced with "Crowd Gear Gets a New Set of Teeth" page 52, December, 1947, THE WELDING ENGINEER.

New Distributors

AMERICAN AGILE CORP., Cleveland, has appointed Industrial Engineering & Sales Co., Pittsburgh, distributor for its welding electrodes and accessories.

* * *

PROGRESSIVE WELDER CO., Detroit, has appointed Hunt-Jordan Co., 1147 S. Independence Blvd., Chicago 24, as exclusive distributor of its products in the Chicago area.

* * *

INTERNATIONAL NICKEL CO., New York City, has appointed Metal Goods Corp., 817 Seventeenth St., Denver 1, Colo., as distributor of primary nickel for alloying purposes and mill forms of Monel nickel and Inconel in the states of Colorado, Wyoming and New Mexico.

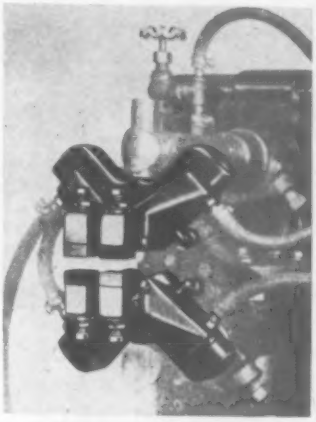
* * *

SOUTH TACOMA WELDING & EQUIPMENT CO., Tacoma, Wash., has been appointed distributor for Hercules bodies and hoists in western Washington.

* * *

ALL-STATE WELDING ALLOYS CO., White Plains, N. Y., has appointed Burnidge Welding Supplies, 204 W. Madison Ave., Pittsburg, Kan.; Amarillo Supply Co., 95 Taylor St., Amarillo, Tex.; Air Products, Inc., of W. Virginia, Wilson and Staunton Streets, Parkersburg, W. Va.; and Jess Bailey Co., P. O. Box 568 E. Second St., Big Spring, Tex., as distributors of its low-temperature welding, brazing alloys and fluxes.

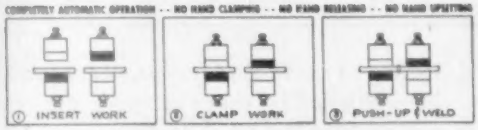
. . . . MAKE YOUR SPOT WELDER A BUTT WELDER IN 2 MINUTES SIMPLE • INEXPENSIVE



HOFFMAN

BUTT-ON-SPOT

AUTOMATIC BUTT WELDING ATTACHMENT


COMPLETELY AUTOMATIC OPERATION - - NO HAND CLAMPING - - NO HAND RELEASING - - NO HAND UPSETTING
① INSERT WORK
② CLAMP WORK
③ PUSH-UP & WELD

WELDING EQUIPMENT MANUFACTURERS USERS DISTRIBUTORS

Write today for information on this time-saving, money-saving attachment.

★ The Hoffman Butt-On-Spot Attachment is a water-cooled, *completely automatic* butt welding attachment designed to fit any spot welder having a minimum horn clearance of 7"—manual, air operated, or motor driven.

Maximum capacity dependent on welder KVA capacity but recommended maximum is ⅜" dia. round stock, 5/16" square stock, and ⅛"x⅜" rectangular stock.

ROBERT W. HOFFMAN CO., INC.

8 S. CLINTON STREET, CHICAGO 6, ILL.

IF IT'S ABOUT WELDING—

IT'S IN

THE WELDING ENGINEER

You Can't Beat The EXPERT Outfit for General Welding

IDEAL FOR DAILY USE IN—

Garage and body shops, cooking utensils and sheet metal plants, airplane factories—wherever general welding is done.

Here's an outfit that has proved its efficiency and economy of use in thousands of shops all over the country. Each unit has been especially designed and selected to provide an outfit complete for every light welding requirement. Adaptable for oxygen, acetylene and hyrdogen gas, for sheet or fabricated metal—ferrous or non-ferrous. We'll be glad to tell you more about this outstanding outfit.

What Equipment are YOU using Now? Meco Write us for the Address of Your Nearest Distributor

MODERN ENGINEERING COMPANY, INC.

3411 WEST PINE BLVD. • ST. LOUIS 3, MISSOURI

POSITIONED WELDING CAN REDUCE YOUR COSTS

Because C-F Welding Positioners make every weld a downhand weld, your welding time and cost is cut to a minimum. Positioned welding permits use of larger electrodes—fillets of correct width and depth can be laid in one pass, with resulting time and material saving PLUS better welding. C-F Positioners with Variable Speed table rotation in any range from 0 rpm and up provide greater flexibility of positioner use in all types of automatic or hand welding. Like all C-F Positioners, these power operated models tilt 135° from the horizontal and full 360° table rotation is possible at any angle.

Investigate the definite cost-saving advantages of C-F Power or Hand Operated Positioners. All models have either variable or constant speed control of table rotation. Write for Bulletin WP.

CULLEN-FRIESTEDT COMPANY

1309 SOUTH KILBOURN AVENUE CHICAGO 23, ILLINOIS

About People

NAT J. WEISS, formerly sales manager for Larkin Lectro Products Corp., has resigned his position to devote his efforts in the promotion of the Nat J. Weiss Sales Associates, which he formed at the beginning of last year, and the American Industrial Equipment Corp., of which he has been president for five years although inactive in its management. Both organizations will operate from 116 49th St., Union City, N. J.

* * *

WALTER G. TUCKER has been elected chairman of the board of the Hydraulic Press Mfg. Co., Mt. Gilead, O. He succeeds COL. H. A. TOULMIN, JR., formerly president and general manager. PAUL C. POCOOK, formerly vice-president in charge of sales, assumes active direction of the company's operations as executive vice-president and general manager. WARREN R. TUCKER has been elected to fill the newly created post of vice-president in charge of engineering and research.

* * *

NORTON P. BOSEMER has been placed in charge of the Los Angeles welding fittings division district office of Tube Turns, Inc. His headquarters are at 1489 Washington Blvd. ROBERT S. TYLER has been named to manage the division's newly established mid-continent district with headquarters at 311 Tuloma Bldg., Tulsa, Okla.

* * *

PETER GROUSTRA, formerly district sales engineer in Detroit for Link-Belt Co., has been appointed district sales manager of the company's new Grand Rapids, Michigan, sales office at 406-7 Murray Building, 48 Division St., North. HERBERT E. WOLF will assist Mr. Groustra in managing the office.

* * *

P. EDWARD MCKENNA has been placed in charge of the stainless steel department of the United States Steel Supply Co., Boston. He is a director and chairman of the membership committee of the Boston section of the American Welding Society.

* * *

JOHN L. FOLEY, proprietor of Buffalo's Welding Supply Center, has been given the responsibility for all production in the United States and Canada of "Publix," the new minicar that is only 6 ft long.

* * *

DR. ROBERT S. LONG has been appointed assistant director of the organic section of the research department, Calco chemical division of American Cyanamid Co., Bound Brook, N. J.

DONALD D. HOGATE, formerly manager of the McGRAW-HILL Washington News Bureau, has resigned to accept a position with the New York Stock Exchange. GEORGE E. DOYING, JR., succeeds Mr. Hogate, becoming chief correspondent of the Washington bureau.

* * *

PAUL H. MERRIMAN, formerly head of the electrical section of the engineering laboratories of the Glenn L. Martin Co., has joined the D. M. Steward Mfg. Co., Chattanooga, Tenn., in the capacity of electronics development engineer. Mr. Merriman is a member of the Institute of Aeronautical Sciences and has been active in the American Welding Society.

* * *

PATTERSON S. WEAVER has been named assistant to general superintendent of Carnegie-Illinois Steel Corporation's South Chicago Works. Kenneth J. Mortimer succeeds Mr. Weaver as superintendent of the plant's production planning department.

* * *

CHARLES T. MARSH, formerly sales and service engineer for Taylor-Winfield Corp., has been appointed sales representative in Illinois and Indiana for Acro Welder Mfg. Co., Milwaukee. His headquarters are at 4022 N. Francisco Ave., Chicago.

* * *

FOREST J. SMITH has been named supervisor of labor relations for Carnegie, Illinois Steel Corp., with headquarters in Pittsburgh. He succeeds A. H. WARDWELL, who becomes director of raw materials for American Steel and Wire Co.

* * *

CHARLES D'W. GIBSON and JOHN A. HILL, vice-presidents of Air Reduction Co., Inc., were recently elected directors of the company.

* * *

DR. A. B. KINZEL, vice-president of the Union Carbide and Carbon Research Laboratories, Inc., has been re-elected chairman of the Engineering Foundation.

* * *

WILLIAM M. LEE has joined the research and development department of the Pennsylvania Salt Mfg. Co., as supervisor of the special products division.

* * *

EARL BLAINE and JOHN DARRAH have been appointed assistant works manager and chief inspector, respectively, for the Budd Company's Huntington Park plant.

* * *

DIED

FRED B. HUSSEY, engineer with the Seattle Oxygen Co., died Oct. 28 in Seattle, Wash.

High Strength

Machinable Welds

In Cast Iron . . .

EASIER . . . FASTER . . . CHEAPER

Talk about sound, strong, machinable welds in cast iron Here's a way to get 'em . . . *but fast* . . . every time. Use Ni-Rod* electrodes"

Ni-Rod's easy-to-control arc speeds up all kinds of cast-iron repair work. Cuts labor, time, and costs. Raises welders' success scores on tough jobs.

Ni-Rod gives you thorough fusion . . . close color match . . . smooth bead that sheds slag. Works on A.C. or D.C.

Stocked in 3/32", 1/8", 5/32" and 3/16" sizes. Order a 5-lb. package today.

*Reg. U. S. Pat. Off.

STEEL SALES CORPORATION

Warehouses

Chicago 23, 3348 S. Pulaski Road
Detroit 10, 5151 Wesson Ave.
St. Louis 10, 4565 Mc Ree Ave.

Branch Offices

Indianapolis 2, 1916 N. Meridan St.
Milwaukee 4, 647 W. Virginia St.
Minneapolis 15, 529 S. 7th St.

SEND FOR FREE INSTRUCTION BOOKLET

Arc-Flex

WELDING & POWER CABLE

IMMEDIATE DELIVERY FROM STOCK

ARC WELDING CABLE CONDUCTOR

A. W. G.	Amperes
6	75
4	100
3	150
2	200
1	250
1/0	300
2/0	375
3/0	450
4/0	550

POWER SUPPLY CONDUCTOR

A. W. G.	Conductors	Amperes
6	2	45
8	2	35
6	3	45
8	3	35
6	4	45
8	4	35
10	4	25
12	4	20
14	4	15

***DISTRIBUTORS*—Write for Price Sheet #115B.**

ARC WELDING SUPPLY CO.

814 Southern Boulevard **Bronx, N. Y. 59, N. Y.**

Weldimatics

WELDING TORCH W-45
Strong and sturdy, 14 inches long, yet weighs only 17 ounces. Lock control for continuous welding. Cuts oxygen and acetylene costs one-third.

BLOWPIPE C-47
Aluminum alloy construction... good balance, comfortable grip. Closed hand releases gas ... open hand cuts it off. Reduces idle flame fire hazard. Works perfectly with natural gas, manufactured gas, butane and compressed air.

WELDING TORCH W-46
Has long lever for closed hand or fingertip gas control, allows wider operating range. Weight, 14 ounces; length, 13 inches.

Meet all Underwriters Requirements

Weldimatics

... are daily cutting costs, reducing fire hazards in many of the world's largest industrial plants. Some distributor territory still available. Write today for descriptive bulletin.

994 OAKMAN BLVD. **Weldit** INC. DETROIT 6, MICH.

Fuse-Well Cast Welding Rods

THE STANDARD OF QUALITY

Throughout the World

•

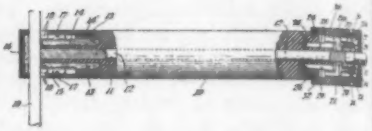
CAST ALUMINUM
WELDING RODS
OF STANDARD ANALYSIS

•

PLAIN AND ALLOYED GRAY IRON
WELDING RODS
AND ELECTRODES

THE CHICAGO HARDWARE FOUNDRY CO.
Dependable Since 1897
148 ENGINEERING BUILDING
NORTH CHICAGO, ILLINOIS

From the Patent Office

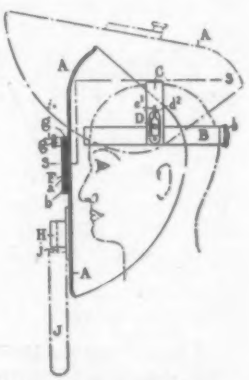


Plunger-Type Electrode Holder

2,428,409. EVERETT H. CUSHMAN, New York City, assigned to AIR REDUCTION SALES CO., INC., New York City. Filed May 21, 1945. Issued Oct. 7, 1947.

An electrode holder having a current-carrying plunger movable axially and clamping means at one end of the tubular body for rigidly clamping an electrode in position to be contacted by one end of the plunger. There is also a means for shifting the plunger axially to move its end into and out of contact with the electrode. The clamping means is insulated from the welding current when the end of the current-carrying plunger is not in contact with the electrode and is capable of actuation to clamp the electrode independently of movement of the plunger.

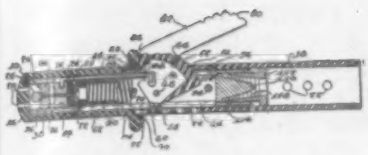
* * *



Welding Helmet

2,425,690. JOHN STRONG, Hyde, England. Filed March 14, 1944. In Great Britain April 7, 1943. Issued Aug. 12, 1947.

A weldor's helmet comprising the combination with a mask portion, of a head harness including an adjustable head band and a second band secured at its ends to the head band and adapted to fit over the crown of the wearer's head. The means at each side of the mask for removably and pivotally attaching the head harness comprises a plate secured to the mask, a pivot pin and a channel-shaped member having resilient legs rotably mounted on the pivot pin. A plate secured to the head harness has two parallel flanges spaced at such a distance apart that the channel-shaped member mounted on the pin can slide between them and be held by reason of the inherent resiliency of its legs.

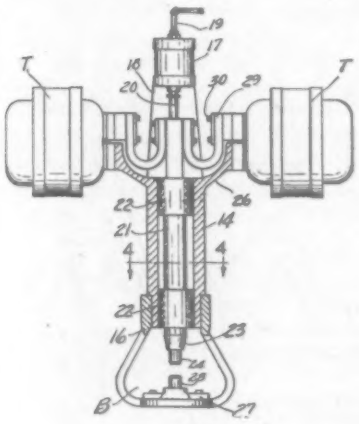


Electrode Holder

2,428,083. JOHAN KOLSTAD, Milton, Mass. Filed May 9, 1945. Issued Sept. 30, 1947.

In this holder a plunger head is slidably mounted in a metallic sleeve having a stationary contact; plunger head is arranged to co-operate with the stationary contact to clamp the electrode in the holder. A coil spring urges the plunger head into clamping position, and means interposed between the plunger head and spring reduces to a minimum the heat conduction and current flow through the spring; the latter means includes a cap shaped to provide a minimum bearing and contact surface and an insulating washer between the cap and plunger head.

* * *



Spot Welder

2,426,280. LEONARD E. NICHOLS, Birmingham, Mich., assigned to RESISTANCE WELDER CORP., Bay City, Mich. Filed Aug. 18, 1945. Issued Aug. 26, 1947.

A spot welder comprising a transformer, a combination center ram and conductor and an outer conductor arranged concentrically about and insulated from the center ram. One of the conductors is mounted for reciprocal movement with relation to other conductor and actuated by pressure means. An opening to accommodate the work is provided in the outer conductor.

* * *

Electrode Coating Composition

2,427,966. CARL JONATHAN HIRSCHLER, New Malden, and WILLIAM GEORGE CAMPBELL, Aylesbury, England Filed Nov. 13, 1944, in Great Britain Nov. 16, 1943. Issued Sept. 23, 1947.

A coating composition for welding electrodes comprising ligno-cellulosic material and a binding agent. The lignin constitutes from about 36 to 70% of the ligno-cellulosic material.

POSITIONED WELDING PAYS!

Speed, Quality Improve—, Costs Drop—with a P&H WELDING POSITIONER

Test after test in plant after plant prove it! P&H Positioners cut welding costs up to 50%—greatly increase welding speed. It's because P&H Positioners enable operators to weld downhand—faster, easier—permit the use of larger electrodes for faster metal deposition. Want proof? Write for Bulletin P2-1!

Features of P&H WP-2 Positioner

- 2500 lbs. capacity
- Faster to operate, more versatile
- Hydraulic power tilting
- 360° table rotation—135° table tilting
- Telescopic elevation
- Manual turning to suit welding speeds (Also power rotation)
- Portable or column-in-floor mounting.

Other P&H models up to 36,000 lbs. capacity

P&H WELDING POSITIONER
4513 W. National Ave.,
Milwaukee 14, Wisconsin
HARNISCHFEGER CORPORATION

THE NEW TRI-ARC

3 in 1 ARC WELDER

WELDING • BRAZING • SOLDERING of all metals

• Output 100 AMPS—operates on 110-220 volts A. C., 50-60 cycles—easy to operate—carry it from job to job—provided with heavy duty electric Arc Torch that gives a flame approximately 9000° F.—meets every welding requirement.

• DISTRIBUTORS WRITE!

UNIT COMPLETE $59.50
TORCH ONLY 14.75

Also manufacturers of famous "PILOT ARC" high frequency unit.

MANUFACTURED BY
TRI-ARC CORPORATION
6859 S. ANTHONY AVENUE CHICAGO 37, ILLINOIS

CHEK-SHOCK OXYGEN CUSHION VALVE

SOFTLY controls the vicious "jolt" of high pressure oxygen gas, thus eliminating regulator repairs and preventing possible injury to operators.

- **Will allow tank valve to be opened rapidly without damage to regulator or danger to operator.**
- **Will increase life of regulator assembly.**
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Flexible Welded Structural Connection

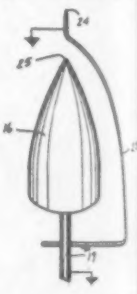
22,905. EMANUEL SCHEYER, New York City. (Reissue) Filed October 23, 1945. Issued Aug. 12, 1947.

A welded shear connection between two structural members, one a horizontal beam subject to bending. The other member has a vertical portion to which the horizontal beam is connected, this connection comprising a vertically extending piece between the beam and the vertical web portion. Welding is done between the piece and each of the members, the welding between the piece and the beam has a vertical space between it and the welding of the piece to the vertical portion; the welding between the piece and the beam comes at the upper portion of the beam and the welding between the piece and the vertical portion is opposite the lower portion of the beam. The latter welding extends a substantial distance above the bottom flange of the beam. The piece is sufficiently flexible between welds to permit it to bend readily, permitting the normal deformation of the beam when subject to bending and largely preventing stress in the welds due to deformation.

* * *

Electrostatic Spray Coating

2,425,652. WILLIAM A. STARKEY, Zionsville, Ind., assigned to HARPER J. RANSBURG Co., Indianapolis. Filed Jan. 22, 1944. Issued Aug. 12, 1947.



A method of spray coating an article having a projecting portion capable of creating an adjacent ionizing zone when the article is in an electrostatic field. Patent covers the steps of creating an electrostatic field over the surface of the article, introducing finely divided coating material to be ionized and electrostatically deposited and reducing the field strength over the projecting portion to prevent reionization of coating particles approaching the portion.

* * *

Welded Bulb and Cap

2,425,448. MILLARD F. WEIDA, St. Louis, Mo., assigned to KNAPP-MONARCH CO., St. Louis, Mo. Filed May 16, 1944. Issued Aug. 12, 1947.

In a welded bulb and cap structure, a bulb having a neck provided with an exteriorly chambered edge presenting a relatively narrow tubular end. A cup-shaped cap loosely fits around the outside of the neck; the top wall of the cap engages the narrow tubular end and is welded thereto to form bulb and cap into an integral structure. Weld is enclosed within the side wall of the cap, interior surface of which is substantially straight axially.

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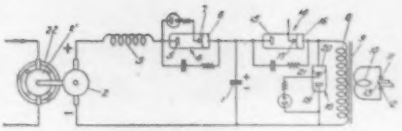

Welding Control

2,428,390. CHARLES G. SMITH, Medford, Mass., assigned to RAYTHEON MFG. CO., Newton, Mass. Filed April 26, 1945. Issued Oct. 7, 1947.

A resistance-welding control system comprising a storage condenser, a load circuit through which condenser is periodically discharged and means for periodically charging condenser during a portion of the period between successive discharges. The latter means includes a generator having a sufficient mass associated with the rotating parts to store kinetic energy during the periods when the condenser is fully charged and to give up kinetic energy to maintain the flow of charging currents to the condenser during the charging period. Between generator and condenser is an inductance of value sufficient to double the voltage of the current supplied to the condenser. A rectifier is placed between the inductance and the condenser.

* * *

Spherical Tank

2,427,676. GEORGE T. HORTON, Chicago, Ill., assigned to CHICAGO BRIDGE & IRON CO., Chicago. Filed March 1, 1945. Issued Sept. 23, 1947.

A spherical storage tank comprising a hollow sphere supported by a plurality of circumferentially-spaced tubular columns attached to the sphere at areas beneath its horizontal equator. Each column is cut out in a surface having the shape of the corresponding section of the sphere to a depth not greater than the diameter of the tubular column and welded at the resulting edges. Columns are each capped at the top with a rounded cap having a sphere-contacting edge portion of the same curvature as the sphere; this cap is attached to both column and sphere by welding. Three angular tie rods each extend from a column to the sphere with the two legs of the rod being welded at the bottom of the sphere. These tie rods are arranged so that the end of a leg of one substantially overlaps the end of a leg of another and all three tie rods form an equilateral triangle when viewed from above.

* * *

High Zinc-Alloys

2,428,959. EDWARD J. BOYLE and EDMUND A. ANDERSON, Palmerton, Pa., assigned to THE NEW JERSEY ZINC CO., New York City. Filed May 17, 1944. Issued Oct. 14, 1947.

A zinc alloy containing at least about 97% zinc, characterized by high creep resistance containing from 0.01 to 1.6% titanium and from 0.05 to 1.5% manganese, the balance zinc.

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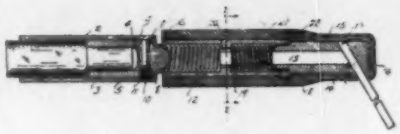

Electrode Holder

2,427,466. RICHARD T. LAWRY, Richmond, Calif. Filed Nov. 20, 1944. Issued Sept. 16, 1947.

This holder comprises a cable-carrying conductor rod having an externally threaded portion and carrying a square spindle. A head member is equipped with a square bore in communication with an angular slot capable of receiving the electrode. Head has a reduced externally threaded portion with threads formed oppositely to the threads of the conductor rod. A clamping nut encircles the threaded portions of the rod and head and is capable of being twisted to effect longitudinal movement of the spindle relative to the electrode.

* * *

Compensated Arc Welder

2,429,075. EUGENE A. SALAY, St. Paul, Minn. Filed Jan. 6, 1944. Issued Oct. 14, 1947.

An arc welding generator in combination with a stabilizer, which includes pairs of series field windings, pairs of commutating poles, a generator armature, a compensated winding extending through the face portions of the field poles, an auxiliary and main winding in the stabilizer, connected in series in the welding circuit. A short-circuit switch for the auxiliary winding varies the turns and a current control switch is provided for the main stabilizer. A means for connecting the switches to operate the same in unison whereby the welding generator current may be compensated to provide a smooth welding arc to minimize spatter during welding.

* * *

Spot Welder

2,429,186. FRED H. JOHNSON, Pleasant Ridge, and CHESTER F. LEATHERS, Detroit, Mich., assigned to PROGRESSIVE WELDER Co., Detroit. Filed April 3, 1943. Issued Oct. 14, 1947.

In a system for controlling the flow of current between a load circuit and a source of alternating current, the current in the load circuit serves to heat the work. The combination for causing current flow to load circuit during each of a succession of "on" periods comprises a controlled plurality of half cycles, means for causing the current during each "on" period to gradually increase from a starting value to a maximum value and thereafter to decrease to a minimum value, means for preventing current flow during "off" periods intervening between "on" periods. Each "off" period has a controlled plurality of half cycles of said source, control means operable to initiate the first "on" period, and means operably responsive to the heating of the work for controlling at least the second and third-mentioned units.

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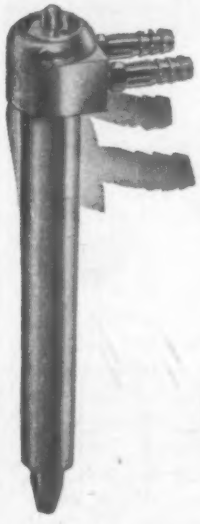

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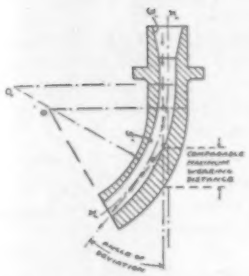
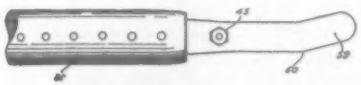


Nozzle for Sand and Shot Blasting

2,428,276. HOWARD L. GRISWOLD, Canton, O., assigned to COAST METALS, INC., Canton. Filed June 28, 1945. Issued Sept. 30, 1947.

A curved sand or shot blast nozzle connecting to a curved bore. The radius of curvature of the bore is greater than the radius of curvature of the nozzle, and the center of curvature of the bore is displaced toward the inlet end of the nozzle. The bore at its inlet end is concentric relative to the axis of the nozzle.

* * *



Electrode Holder

2,430,376. FRANK G. VAN DYKE, Detroit, Mich., assigned to BORDON MFG. CO., INC., Detroit. Filed Feb. 1, 1943. Issued Nov. 4, 1947.

In an electrode holder a pair of gripping members are adapted for gripping an electrode. A groove between the faces provide for reception and determination of the position of the electrode. A passage between the members rearwardly provide for the free reception of an inserted end of an electrode. There is an engagement portion on the jaws for engaging and forming a fulcrum for the electrode upon swinging of the same in one direction; a second engagement portion swinging the electrode a predetermined distance in one direction, engaging and forming a fulcrum upon swinging it in the opposite direction. In the location of the second engagement portion a groove is such that upon swinging of the electrode in the opposite direction, the electrode will have moved into registration. The electrode being of sufficient size spreads the jaws apart upon swinging.

* * *

Arc-Welding Converter

2,429,273. MONTFORD MORRISON, Upper Montclair, N. J. Filed Jan. 8, 1944. Issued Oct. 21, 1947.

A synchronous converter device fed from a three-phase supply circuit which provides unidirectional output current for arc welding loads, and consists of a three-phase synchronous converter connected to a three-phase supply circuit. The converter has a commutator provided with one brush adapted to carry arc welding load currents and an arc load circuit including an inductive reactor. The arc load circuit is connected between the brush and one conductor of the supply circuit.

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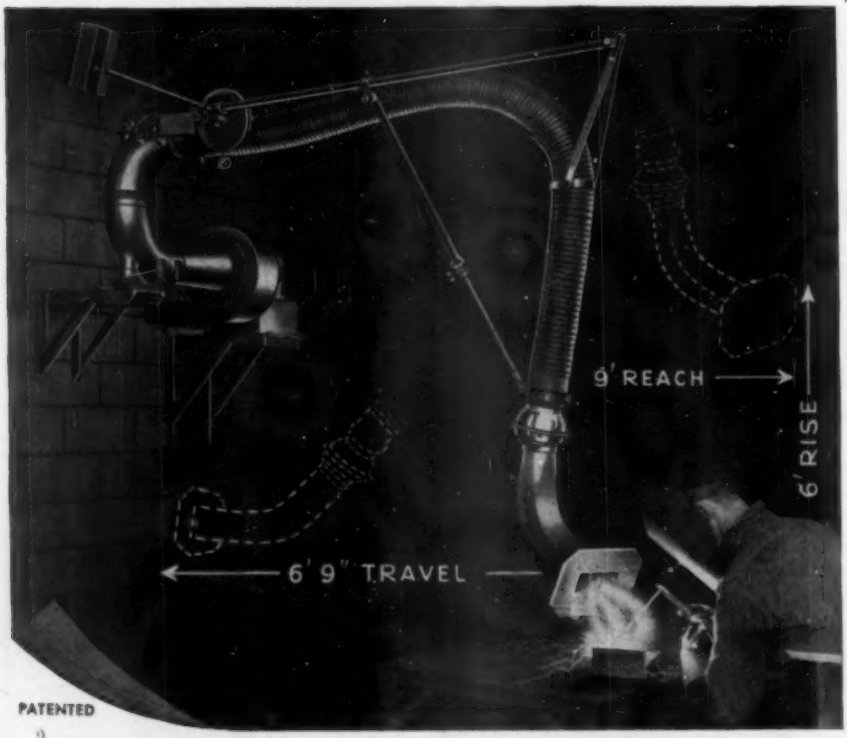

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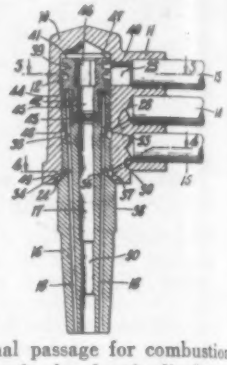
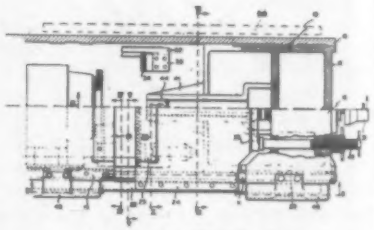
Cutting Torch

2,430,531. SAMUEL R. OLDHAM, West Orange, N. J., assigned to UNION CARBIDE AND CARBON CORP., New York City. Filed Dec. 17, 1942. Issued Nov. 14, 1947.



A torch head having a cavity and spaced inlets for combustion supporting and fuel gases, and a relatively short and thick nozzle extending within and coöperating with the cavity. Nozzle has a longitudinal passage for combustion supporting gas and other longitudinal passages for preheat gas. The cavity and nozzle have annular chambers respectively communicating with the inlets. Both have threaded portions interposed between the chambers for securing the nozzle in cooperating relation. The inside of the annular chambers is larger than the internal diameter of the threaded portions and connected for combustion supporting gas. Chamber is positioned ahead of the threaded portions and being larger than the inlet, the inner end of the nozzle has an extension beyond the threaded portions and extends into the chamber and out of contact with the cavity wall. Following the contour of the cavity, substantial gas contact is provided by combustion supporting gas from the inlet which passes over and around the extension in the innermost chamber. It is ejected through the combustion supporting passage to form a cutting jet.

* * *



Flash Welder

2,430,787. MELVIN M. SEELOFF, Warren, O., assigned to THE TAYLOR-WINFIELD CORP., Warren, O. Filed June 7, 1945. Issued Nov. 11, 1947.

A flash-butt welder comprising in combination, a pair of spaced parallel upright plate-like frame members, a fixed platen rigidly inter-connecting frame members and having surfaces abutting the top and inner side surfaces of the frame; a header member housing a cylinder rigidly interconnecting frames at points longitudinally spaced from the fixed platen and having surfaces abutting the top and inner side surfaces. A longitudinally extending side rail is slideably mounted for longitudinal movement on each of the frames, a movable platen supported on the side rails, a piston in the cylinder having a rod which engages the movable platen and means to guide it.